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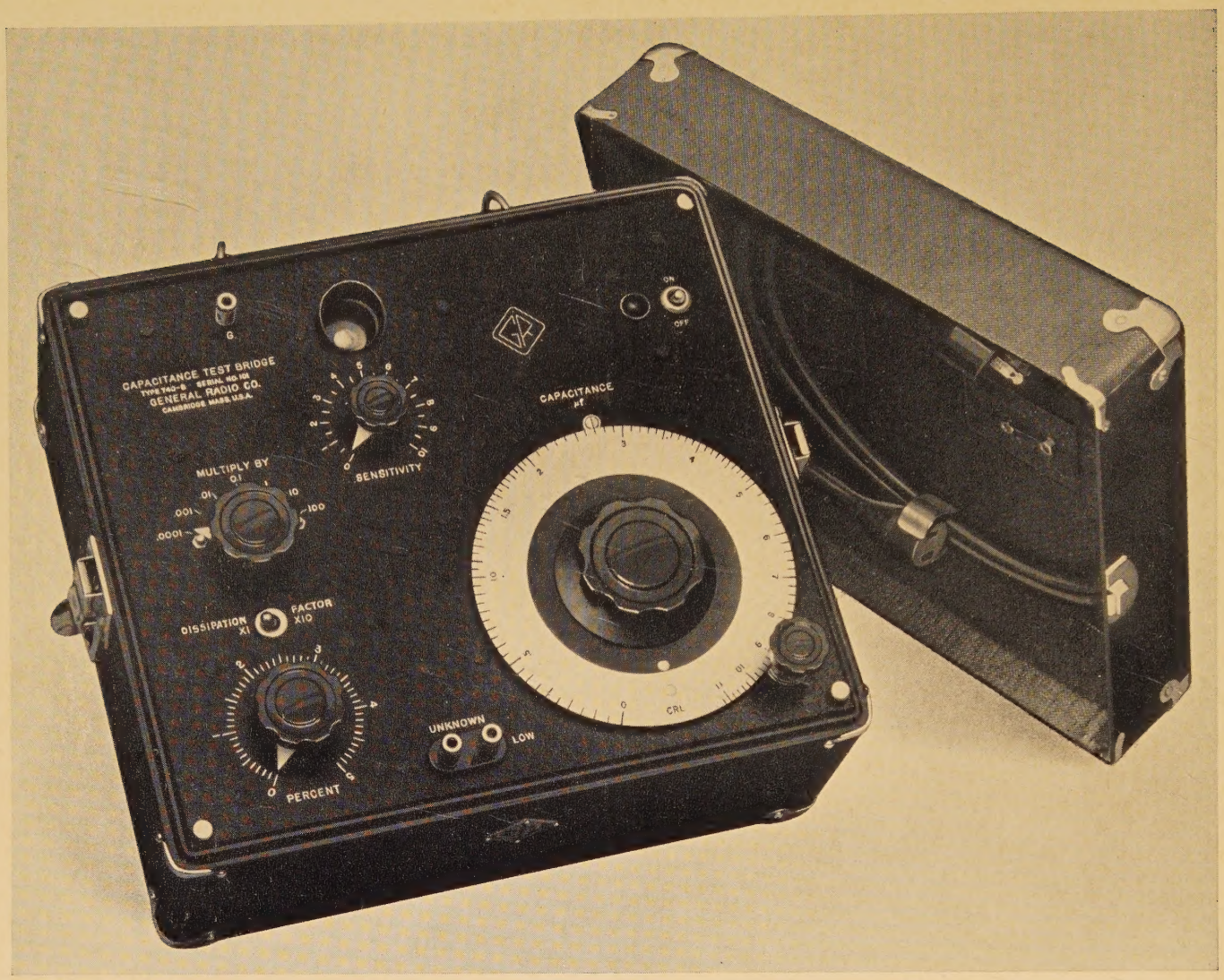

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Electrical Engineering

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for July 1938—

*Transactions Section—Papers and Correlated Discussions** *(Follows EE page 328)*

* For discussions of previously published papers, see next page.

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(Founded 1884)

W. H. HARRISON, President H. H. HENLINE, National Secretary

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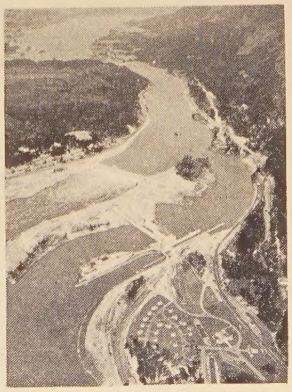
The Cover

Bonneville dam on the Columbia River, which may be visited by those attending the AIEE 1938 Pacific Coast convention (see pages 295–7)

Brubaker Aerial Surveys



High Lights

Printing Telegraph for Way Wires. Most commercial telegraphic trunk circuits have been operated by printing telegraph methods for several years, but Morse-code operation generally has been used on way wires. New equipment and methods for operating way wires by printing telegraph include a polar simplex system, a neutral way-wire system, a calling-bell system, and a multistation customers' printer circuit that provides secrecy of communication by preventing the connection of more than one customer's printer to the line at the same time (*Transactions pages 365–72*).

Amplifier for Measurements. Modern electric instruments are reliable and accurate, but for some applications their energy consumption is undesirably large when connected directly into the circuit. For an a-c network analyzer, which requires instruments having a high degree of accuracy with extremely small energy consumption, a stabilized vacuum-tube amplifier to be connected between the analyzer circuit and the indicating instrument has been devised (*Transactions pages 379–84*).

Phanotron Rectifiers. In areas where electric utility companies have discontinued direct current in favor of a-c distribution, a-c elevator equipment may have to be substituted for existing d-c apparatus; the alternative is to provide a converter for supplying direct current to the existing equipment from the a-c mains. The use of phanotron rectifiers for this purpose has some advantages (*Transactions pages 385–90*).

Pacific Coast Convention. The scenic beauty of the Pacific Northwest awaits those who will combine their vacation trips with attendance at the AIEE 1938 Pacific Coast convention, to be held in Portland, Ore., August 9–12. Convention features include an excellent technical program, an all-day inspection trip to the Bonneville dam, and a variety of sports competitions (*pages 295–7*).

Railway Circuit Breaker. Railway trolley service imposes severe duty on circuit breakers because of the frequency of short-circuit operations. A breaker operating on the so-called impulse principle has been built to interrupt 65,000 amperes at 15,000 volts in one cycle, and is expected to handle 50 operations without internal inspection or change of oil (*Transactions pages 359–64*).

Economic Status. Monetary returns in the profession of engineering compare favorably with those in other professions, according to an analysis of data obtained from more than 50,000 engineers. Personal qualities, rather than technical education, are believed to influence the separation of engineers into various salary levels (*pages 281–5*).

The Engineering Library. The engineering library may be regarded as a laboratory; like other laboratories, it is a place for study and research. According to one authority, library research indubitably is the proper first step in any investigation and may save much time-consuming expensive experimental work (*pages 291–4*).

New Type of Vacuum Seal. A new type of lead-in structure for airtight, gastight, and oiltight chambers employs porcelain bushings sealed to metal by means of a special glass. The method of making the seal is said to be simple, requiring no special skill or elaborate equipment (*Transactions pages 373–8*).

High-Voltage Fluorescent Tubes. A recent innovation in high-voltage gaseous-discharge tubes—the use of fluorescent materials coated on the insides of the tubes for producing light of different colors—eventually may change the whole complexion of advertising and architectural lighting. (*pages 286–90*).

Transients. Illustration of transients on transmission lines by motion pictures has been found to be an educational aid; drawings for the films and three-dimensional models were prepared from data for d-c transients obtained experimentally on an artificial line (*Transactions pages 391–400*).

Board of Directors Report. The annual report of the AIEE board of directors to the membership, for the year ending April 30, 1938, appears in full in this issue. It contains reports of the various committees and the usual financial tabulations (*pages 305–15*).

Summer Convention. At the AIEE 1938 summer convention, just concluded at Washington, D. C., as this issue goes to press, new officers were elected and the enactment of constitutional amendments was announced (*pages 303–04*).

Lenox Meeting. Power-system operating problems and industrial applications featured the technical program of AIEE North Eastern District meeting held at Lenox, Mass., May 18–20. More than 400 registered (*pages 298–302*).

Pamphlet Papers Available. A limited supply of pamphlet copies of papers presented at recent AIEE conventions and District meetings is available; the list is accompanied by a convenient order form (*page 328*).

Coming Soon. In addition to articles and papers mentioned in the "Coming Soon" items in previous recent issues, the following are now undergoing preparation for early publication: an article reviewing the status of rural electrification in England; a paper discussing resonant nonlinear control circuits and their applications, by W. T. Thomson (A'37); and a paper analyzing the effect of amortisseur windings on overvoltages caused by unbalanced short circuits on electric-power systems, by Edith Clarke (M'33) C. N. Weygandt (A'37) and Charles Concordia (M'37).

News 295

DISCUSSIONS

Appearing in this issue are discussions of the following previously published papers:

Electrical Machinery

Instruments and Measurements

Power Transmission

Statements and opinions given in articles and papers appearing in ELECTRICAL ENGINEERING are the expressions of contributors, for which the Institute assumes no responsibility. Correspondence is invited on all controversial matters. ¶ Subscriptions—$12 per year to United States, Mexico, Cuba, Porto Rico, Hawaii, Philippine Islands, Central and South America, Haiti, Spain, Spanish Colonies; $13 to Canada; $14 elsewhere. Single copy $1.50. ¶ Address changes must be received by the fifteenth of the month to be effective with the succeeding issue. Copies undelivered because of incorrect address cannot be replaced without charge. ¶ ELECTRICAL ENGINEERING is indexed annually by the Institute, weekly and monthly by *Engineering Index*, and monthly by *Industrial Arts Index*; abstracted monthly by *Science Abstracts* (London).

Number of copies this issue—20,700

President Harrison Emphasizes the Institute's Fundamental Responsibilities*

IN presenting this talk, I am fulfilling a provision in the constitution of the Institute which says that the president ". . . shall deliver an address at an annual convention." At the outset I want to express for the other officers and directors, and for myself, appreciation and gratitude for the enormous amount of voluntary effort put forth by the members on behalf of the Institute. I want especially to commend Mr. Henline and his associates on the headquarters staff for their effective and constructive work during the past year, and for the gracious manner in which they have met the demands of officers and members alike.

Along with the honor of the office and the privilege to serve, the president has responsibilities to the Institute. One of these takes form in an obligation to tell of any impressions he may hold as a result of experience and association with the members and officers throughout the various Sections.

Having enjoyed visiting with some 40-odd Sections, embracing more than 70 per cent of the membership, and having been exposed to their views, I do hold certain impressions which I think pertinent to touch upon at this time. These impressions have to do with the extent to which the Institute should be a force in the determination of considerations which lead up to the use of public funds in fields which heretofore have been largely developed by private initiative.

In this I am mindful of the concern with which many in the profession view—and not without merit—the increasing participation of Government agencies in commercial enterprises, particularly in fields already adequately served. Perhaps an important transition is under way. We well may be at the start of a long-range cycle of change. Certainly it would be a misconception to assume that the present state of affairs is merely the result of a statute, a political situation, or a business cycle. Looking at the Institute in long-range perspective and with these things in mind I am confident that we best can serve the interests of the public, the industry, the profession, and the Institute itself by continuing to follow the broad ground rules upon which the Institute was founded, and which are stated in its constitution in these clear words: "Its objects shall be the advancement of the theory and practice of electrical engineering and of the allied arts and sciences and the maintenance of a high professional standing among its members." These simple words express the whole idea back of the Institute and its activities. The distinguished record of service attests to the soundness of these principles.

Considering this whole matter broadly, we must realize that every conceivable social, economic, and political philosophy is to be found in our membership. It must be clear, too, that only the united and unselfish effort of the membership has made the Institute the force it is. To destroy this unity, which in my judgment would be the case were the Institute to enter on a national basis a field so full of conflict of thought and of economic interest, and so sacred to the individual as are his social, economic, and political views, would be to sacrifice the fulfillment of the principles for which the Institute was founded.

From the time of its first technical meeting (at Philadelphia in October 1884) up to the present, every electrical development of substantial importance has been described and discussed in the Institute's meetings and publications. We can get a vivid picture of the value of these developments by imagining for a moment what would have to be done over again to bring us back to our present state if the knowledge in the many volumes which constitute the printed record of our proceedings and the things which this knowledge has made possible were, by some disaster, to disappear. It would, for example, be necessary to develop the whole art of a-c transmission and distribution, of electric traction, of radio and modern wire communication, and almost the whole arts of electric lighting and other means of power utilization.

It would be necessary again to bring forth the technical and theoretical genius of men like Edison, Elihu Thomson, Steinmetz, Kennelly, Pupin, Campbell, Sprague, Lamme, and many others; and the genius for adaptation and application of men like Westinghouse, Dunn, Carty, Rice, and others, all of whom are, or in their lifetimes were, interested and active members of the Institute who contributed most generously to the fulfillment of its objectives. No one can say that if there had been no AIEE these things would not have been done or that these men would not have applied their great talents for the good of mankind either as they did or in some equivalent way. But neither would anyone deny that the Institute actually was a vital and constructive influence in shaping events and careers as we know them today.

The Institute, with this proud record and background of service, will continue to be a living influence in the development and application of the electrical sciences and arts. The inspiration and knowledge gained from its meetings and discussions and publications, the stimulation and encouragement of the prompt recognition and honors awarded for noteworthy achievement, the opportunities it affords for the prompt announcement and critical examination under appropriate auspices of new technical developments and ideas, always will be essential elements in the progress of electrical engineering.

The importance and degree of influence of the Institute's job depends upon the increase in the knowledge of the electrical sciences and the electrical arts and the

* Notes used by Retiring President W. H. Harrison in speaking before the summer convention general session, Washington, D. C., June 22, 1938.

extent of their application to the service of man, and seems clearly to me to be independent of the forms of social and business organization which administer their application.

Certainly there is not now, nor is there apt to be in the future, any dearth of things to do that are strictly within our province. The frontiers of knowledge of electrical science and arts—technical and commercial—are expanding constantly and there is nothing to indicate they will not continue to expand. In our unimaginative moments we sometimes may doubt this. Sometimes it may seem to us that nothing is possible in the future that can be compared with the opportunities and achievements of earlier days. As a matter of fact, this is a common characteristic of every generation. History records a succession of prophesies wherein little or no hope is offered for the "future." Such prophecies and beliefs are as groundless and false now as they so obviously were throughout all the past.

Even during these last few years of depressed business, many noteworthy advances have been discussed at Institute meetings. At this summer convention, for example, papers are being presented that describe the practical application of the principles of fluorescence in the production of light. Likewise, there has been a good deal of work and progress in the use of electronic devices in power application. Within just the last year or two we have been told about interesting and important discoveries concerning natural lightning and about experiments on an imposing scale with artificial lightning. Also at this convention, as well as at last winter's convention, papers were presented describing new instrumentalities that will have a far reaching effect on the future development of the telephone art. Television is another new development about which we are learning more and more. This development has a romantic and even fantastic aspect that has been exceeded in degree by few, if any, of the numerous developments about which the Institute has been told in the past.

These are but a few examples. In every branch of the industry there are similar concrete indications of a vigorous and fascinating future. And if at the moment each of us cannot put his finger on a definite example in his own special branch of the art, we all at least can agree that we have not yet arrived at perfection in any field and each of us without much trouble can point to important parts of our work that remain undone, perhaps because we don't know how to do them.

We may be sure that man's inventive spirit and curiosity will find ways to do these things, or alternative things that will be so much different and better that we do not have the boldness even to imagine them. In this field of expanding activity the Institute has before it a continually increasing opportunity for service to the profession and to mankind. We can be proud of the part the Institute has played in the development of an industry which, in an era of free enterprise, has given this nation of ours commodities and services that are more extensively used, are better in quality, and are lower in price than anywhere else in the world. With six per cent of the world's population and five per cent of its area, the United States uses a third of the world's electric energy and half of its communication services.

We now are in a period of change—in social and political organization, and in the relation of the individual and of business to government. Lest there by any misunderstanding, I want to emphasize that the Institute's job will go on irrespective of these trends; that the Institute recognizes its responsibility to its members and to society at large to continue to advance the development and application of the electric sciences and arts and thereby to enhance the comfort and enrichment of mankind and the professional status of its members. We have an enviable record of achievement. We are rich in the tradition of service. Our future depends upon the increase in the knowledge of the electrical sciences and arts and the extent of their application to the service of man, and to me seems clearly to be independent of the forms of social and business organization which administer their application.

"The Engineer of the Future"

"THE ENGINEER of the future is going to make tremendous strides in this matter of studying human beings and. . .when he does so he will become the industrial manager of the world. This subject of management is in reality a branch of engineering, at least in this country. . . where in the last 40 years engineering has been always developing work which has been managed exclusively by engineers. Management is one of the great opportunities lying before the young engineering man; and some of the fields of management are so highly developed that we can give courses and write textbooks about them. . . .

"Of course there are a lot of other problems in this field. . .for instance, the very important problems of industrial relations between employer and employee. There is no group of men in industry today that is closer to and understands better the problems of both the employee and the employer than do the engineers. They can look upon the problems of both groups objectively.

"One of the great problems of industry today is the selection of men for executive positions. The right man must be bred, trained, and finally recognized in the group. The average life of an executive is between five and seven years. Sometimes he quits, sometimes he has a nervous breakdown, often he dies. One of the great problems in management is what can be done to keep this man on the job eight years instead of six. That entire field is one that people are tackling from an engineering point of view. The engineer, trained in habits of thought, is seeking the solution of these problems. The engineer should turn out to be a useful contributor in the world of economics as he has long since proven himself to be the best production manager in the world."

From an address of the same title delivered by President Harvey N. Davis of the American Society of Mechanical Engineers, at the spring meeting of the society, Los Angeles, Calif., March 25, 1938.

The Economic Status of the Engineer

By ROYAL W. SORENSEN
FELLOW AIEE

Data gathered by the Bureau of Labor Statistics are used by the author in this article to support his statement that "the economic status of the engineer is largely a matter determined by each individual engineer according to his particular personal qualifications and the relations these bear to the work he does and to the personalities of those persons with whom and by whom he is employed."

THE ECONOMIC status of the engineer is bifunctional in its scope—one part deals with the value of the integrated work which all engineers have contributed to the progress and welfare of mankind; the other part has to do with economic recognition in the way of social position and salary which engineers and their families receive in return for service rendered.

The study on which this article is based shows conclusions which may be briefed as follows:

Engineers, though suffering considerable loss of income and employment during the recent years of business depression, on the whole have fared much better than most classification groups, be they government, capital, profession, or labor.

Preceding the depression, there was no lack of employment for engineers and their compensation for the most part was equitable in comparison with the pay for other types of service.

The verdict of users of engineering service regarding the reasons why engineers who have not made satisfactory progress professionally or in their economic status is almost unanimous that such failures are due to deficiencies in personality, general culture, tact, industry, and so forth, rather than the result of lack of technical training.

Graduation from college is prerequisite to success in engineering, but per se does not guarantee an engineer.

The education obtained by taking engineering courses and engaging in the practice of engineering for most of those who have chosen the routes thereof has led to "the more abundant life" and a better economic status than the lots of the families from which engineers have come.

In the September 1932 issue, ELECTRICAL ENGINEERING announced for the first time the appointment of a committee to be known as the "Committee on the Economic Status of the Engineer." The function of the committee is set forth in Institute by-laws, article III, section 83, which says this committee "shall consist of five members, and shall consider matters relating to the position, function, and responsibility of the engineer in the development of human welfare, and make reports and recommendations to the board of directors thereupon. The committee shall co-operate with similar committees of other engineering societies, and shall also consider and report upon all matters referred to it by the board of directors, the president, and the national secretary." The language of this article shows wisdom in its formulation and clearly charges the committee with the duty of keeping informed and advising the members of the Institute, through its board of directors, of ways and means whereby they may be of service to mankind. Such responsibility would be overwhelming, were it not for the fact that all engineering aims at exactly the goal specified.

The world's economic evolution has resulted in much classification of the workers responsible for changing the habits of its citizens from those of the jungle to our present complex but regal standard of living, though jumbled be its attendant economic program under which we are muddling along.

One group of these workers is known as the professional men's group. Professional men are, perhaps, best defined by saying they are men who have professional education; that is, "the training that fits men for special vocations in which science is applied to the practical purposes of life. It supposes, as its basis, the knowledge and discipline which general culture affords."

Defining the Engineer

Many attempts have been made to write an all-inclusive definition for the engineer, but the rapid march of time has made each effort obsolete, even as the progressive science of engineering rather than the wearing out of machines has relegated many engineering products to the oblivion of the obsolete.

Engineers qualify as professional men by having professional education. Government research as to the "Educational Qualifications in the Engineering Profession" shows:[1]

"A first degree in engineering is now almost a prerequisite in order to obtain professional status and a position. Postgraduate work, however, is important only in a few of the professional classes. The tendency of engineers to transfer from the course of college specialization to other classes of work is negligible. These are a few of the facts developed in the survey of the engineering profession, which was undertaken by the Bureau of Labor Statistics in May 1935, at the request of the American Engineering Council."

Figures on which the above statements are based show that only 1.52 per cent of the engineers who began practice between 1930 and 1934 were not graduates. For all years up to 1929, 27.6 per cent of all engineers were not gradu-

Essential substance of a paper presented at the AIEE summer convention, Washington, D. C., June 20–24, 1938.

ROYAL W. SORENSEN is professor of electrical engineering at California Institute of Technology, Pasadena. A native of Kansas and a graduate of the University of Colorado, he became a member of the faculty of Throop Polytechnic Institute (now California Institute of Technology) in 1910, following several years, experience with the General Electric Company. In 1911 he was made professor; in addition, he has been engaged in consulting practice. He is the author of several AIEE papers; was a vice-president 1933–35; and is currently a director of the AIEE. He is chairman of the committee on economic status of the engineer, and a member of the committee on Student Branches.

1. For all numbered references, see list at end of paper.

ates. For all years up to 1935, 17.7 per cent of all engineers were not graduates. For all years up to 1935, 13.3 per cent of all electrical engineers were not graduates. Also the number of engineering graduates with more than one degree is very small, namely, one-half per cent and one-tenth per cent only having, respectively, masters and doctorate degrees.

The doubt expressed as to the importance of postgraduate work is challenged, because graduate work in engineering colleges is too new to provide enough statistical data to draw conclusions as to its value. There is strong evidence, however, that men who are qualified for and have completed graduate courses which are provided in properly manned and well equipped colleges for the study of modern science and mathematics as applied to engineering, have, for the most part, advanced in professional status at rates which show justification for graduate work. In the author's opinion, the limited number of men who have the special scientific and mathematical ability to warrant the continuation of postgraduate work unto the earning of a doctorate degree (and no others) should be encouraged toward that end.

A poet scanning these data and writing in Biblical language might well say, "It is easier for a camel to go through the eye of a needle than for a man to become an engineer without the advantage of graduation from an engineering college," or expressed in current language of the street, it may be said, "The odds are better than 98 to 1 you cannot be an engineer without graduation."

In fact the engineer finds that graduation does not end study, but that he must supplement his practice by continued study else he will lag behind just in proportion as his interest in research and study wanes. Perhaps, therefore, it will be easier to determine who are engineers by the manner in which they do their work rather than to judge by graduation, license to practice, or by passing examinations, often irrelevant to the kind of engineering done.

The law says a boy becomes a man the day he is 21 years old, but, except for legal privileges and voting, no change takes place on the 21st birthday, but rather a boy becomes a man when he puts away childish things and meets his problems in a manly way.

So it is with becoming an engineer. A man does not become an engineer because he graduates, or because he completes a test course and becomes a good draughtsman, mechanic, calculator, designer, or professor of electrical engineering. He becomes an engineer when he diligently and intelligently uses his God-given and hereditary talents, his education, his environment, his background, and his personality to produce new ideas and, through the medium of the crafts mentioned, finds ways and means for putting these ideas to work and makes a scientific analysis of his procedure in order that he may proceed by the engineering method rather than by cut-and-try or empirical methods.

Engineers, perforce, must at once be very co-operative and very individualistic. The co-operative characteristic is necessary because engineering problems of today are too large for one man to solve, and must be worked out by groups of men working in such close relationship as often to make practically impossible any acknowledgment as to the source of key ideas which unlock the problem solutions. Engineers must be individualists in order that each may contribute his share to the profession, by discovering in the daily tasks performed, new problems and their solutions. As illustrative of the latter point, consider the 27 Edison Medalists, beginning with Elihu Thompson and including the most recent one, Gano Dunn. No two of the entire 27 have traveled even similar paths to success. In fact, in all engineering history there are probably no case records which show that two engineers have done identical work, even in instances where promotions and other causes have made vacancies in organizations that result in succession appointments.

Thus we see that engineers in their relations with their work and fellow men have true professional status in that the particular contributions of each engineer to society are unique.

Economic Recognition

The other phase of the economic status of engineers, bluntly stated, is to what extent does all this work enable them to provide themselves and their families with good social positions and the use of the facilities for human betterment which engineers have made available. This part of the question, while not specifically mentioned in the Institute by-laws, is implied by the name of the committee, and committee consideration thereof is expected by the Institute members.

Statistical data regarding employment and income are now available in bulletins published by the United States Department of Labor, Bureau of Labor Statistics. Parts of the data in these bulletins have been published in ELECTRICAL ENGINEERING.

Table I. Comparison of Five Levels of Annual Earnings for All Professional Engineers Reporting in 1929, 1932, and 1934

Figures derived from adjusted data as explained on page 4 of bulletin, and without regard to employment status reported or type of education

Per Cent at Specified Income Level	Annual Earnings of More Than Specified Amount		
	1929	1932	1934
10	$7,466	$5,605	$5,138
25	5,012	3,827	3,429
50	3,412	2,574	2,286
75	2,509	1,698	1,473
90	1,878	889	872

A study of these data and much other information obtained from the printed page, by discussion with others, and by experience on the part of the author, seems to warrant the conclusion that the economic status of engineers in comparison to that of other citizens is for the most part reasonably equitable, though many engineers are of the opinion that the members of the engineering

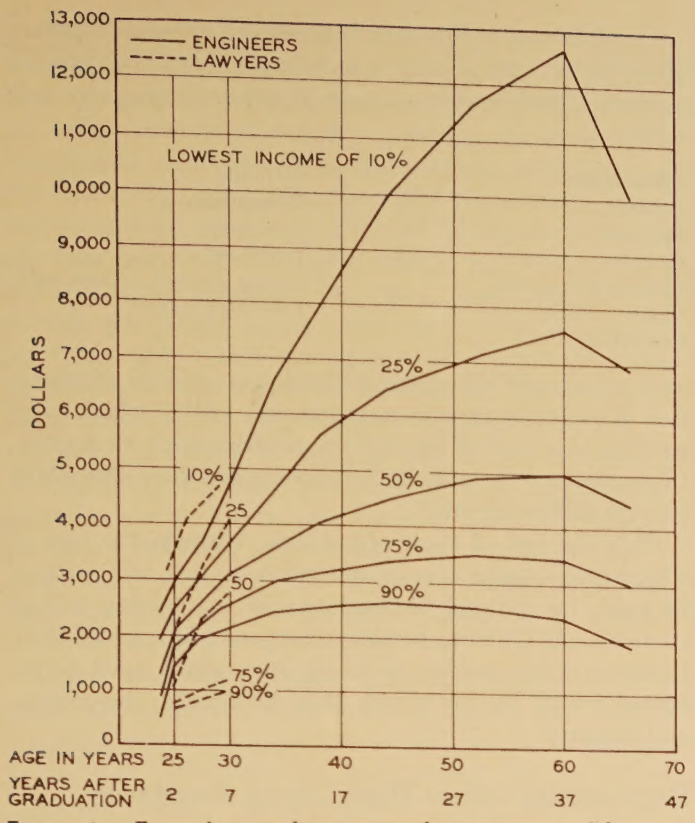


Figure 1. Earned annual income of engineers and lawyers according to age

Curves for engineers represent the findings for all the engineers of the United States; curves for lawyers represent the findings for California lawyers admitted to the bar in 1931

profession have received less reward than their work warrants.

Bulletin No. *R.* 497[2] opens with the sentence: "As far as is known, the recent depression was unique in its disastrous repercussions upon professional groups." This, after all, is just another way of saying the depression was terribly severe, extending even into the professional groups to such an extent as to show a simultaneous unemployment of about 11 per cent of all engineers, all of the several engineering classifications suffering to about the same degree, as might be expected, there was a greater percentage of unemployment for engineers over 53 or under 27 years of age. Summary analysis number 9 of this bulletin says:

"9. The type of education the professional engineer had received did effect variations in both the incidence and severity of unemployment. These factors were very much less for postgraduates than for engineers with other types of education. But as between engineers with first degrees in engineering and those whose college course was incomplete or who had attended noncollegiate technical schools, the differentials were very slight."

Other information shows less than three per cent of the graduates of some engineering colleges unemployed at any one time during the depression years 1930–35. No comparable data being available for the other professions, it is difficult to know just what a reasonable standard of depression unemployment should be, but there is every reason to believe that lawyers, physicians, and dentists, though busy, did not fare any better than engineers in regard to net income received for service rendered. It is also very certain that engineers, in that respect, fared better than skilled mechanics and other craftsmen who constitute much of our working citizenry.

Bulletin No. *R.* 543[3] shows among other things that during the five-year period of rampant unemployment, the number of engineers graduating into the profession was 25.3 per cent the number engaged in engineering in 1929. Since the nation-wide unemployment of engineers at any one time reached a maximum of 17.7 per cent, there was, even during unemployment times, a considerable amount of employment for the beginner in engineering. The number of engineering graduates, therefore, probably was not too high for normal times and the indication is that all should be needed by industry, if only persons well qualified for engineering work choose to enter the profession.

Bulletin No. *R.* 588[4] presents much very interesting data. The accompanying table I is part of table III of this bulletin. The table shows that in 1929 all but ten per cent of the engineers received wages equal to or better than the wages of skilled mechanics, as published in Bulletin No. 616, "Wages and Hours of Labor," which lists the pay for skilled and unskilled labor in many industries and shows mechanics' wages are $25 to $35 per week with occasional skilled occupations paying larger amounts.

Opportunity Outweighs Pay

First-degree engineering graduates start work at about $25 or $30 per week. Graduates with master's and doctorate degrees start at from $30 to $50 per week, the latter amount being reserved for men of special ability. These rates of pay appear just—the mechanic or skilled laborer being paid a premium over the common labor wage in recognition of his skill and the cost of its acquirement. The wage premium for neophite engineers is a recognition of the fact that time and money have been required for college training which will enable them to become engineers, rapidly, rather than as recognition of acquired proficiency as in the case of mechanics. The pay received by men just out of college, provided it keeps them from want, is relatively unimportant, as compared to opportunity for advancement in responsibility and salary. Salary advances for engineers of the United States and for lawyers of California, so far as the latter information is available, are compared in figure 1. The curves applying to engineers are taken from figure 1 of reference 4. The data pertaining to the lawyers of California is from an unpublished "Digest of a Survey of the Economic and Professional Status of California Lawyers During the First Five Years of Practice," prepared in 1937 by the committee for cooperation between the law schools and the state bar.

The curves for the engineers show favorable advancement in salary with age and experience for the upper half of those in the profession, as also does the rather limited data for the lawyers. It is interesting to note the long rise in earning capacity extending unto a man's 60th year of age and 37th year of practice. Observation, without confirming data, creates the opinion that lawyers and physicians follow the same laws in this respect. No actual

data have been made available for physicians, but an oral check with a number of them brought forth statements, all in agreement, to the effect that in the opinions of those interviewed, the curves for the engineers were, on the whole, indicative of the net salaries for physicians—the average for the physicians being perhaps a little better than the average for engineers; but less than ten per cent of the physicians have net incomes above the ten per cent curve for engineers.

All this information seems to indicate equity in the income of engineers as compared to skilled laborers, lawyers, and physicians.

The professional men are indeed fortunate in having occupations which provide for increasing service to fellow men as years add to skill and experience, and also in having at the same time increasing incomes which grow apace with the family expenses and often continue to grow beyond the period required to get the children established in their own homes and occupations.

Those of our profession who disagree with these findings, particularly as they apply to engineers, have two arguments against them—one the apparent greater expenditure of money by lawyers and physicians as compared to that of the engineers, which they have witnessed. It must be borne in mind that some of the expenditure made by physicians and lawyers is for office equipment and automobiles that must be used in connection with the practice of these professions. Also it is worthy of note that the expenditures which attract attention are usually those made by the more prosperous, rather than by the representative members of the profession.

Moreover, comparisons which men make purely by observation, rather than on the basis of exact data, between the spheres of their own activity and those of others, generally result in optimistic interpretations regarding the outside spheres, with a simultaneous pessimistic appraisal of their own. "The grass on the other side of the fence is always greener."

The second objection has to do with the exactness of the data obtained from returned questionnaires as compared to that which would have been available, had every engineer in the land returned a complete questionnaire. A complete report, would, of course, be impossible except by absolute governmental decree ordering a census of all engineers, but the data available which came from the 52,589 engineers who properly filled out and returned the questionnaire should give a fair cross section of the 167,268 engineers who received them.

Assuming the data used to be representative, the analysis has narrowed to two questions: (1) Why is there such great spread in income for men in the same profession who have gone through the same training courses, been subject to the same tests as to ability, and have survived the same processes of selection? (2) What are we going to do about it?

Many educators and others have often asked these questions and made surveys of industry, hoping thereby to find the answer, but all have ended with only a variety of general but authoritative statements by those who employ engineers. Some of these statements are:

Graduates of engineering colleges fail to reach expected goals not because of lack of technical education but rather because of deficiencies in those qualities described by such terms as:

Personality	Aptitude
Loyalty	Promptness
Patience	Accuracy
Humility	Judgment
Breadth of interest	Proper estimate of own value
Business ability	Executive ability
Leadership	

with sometimes the comment that there is lack of education in basic science and mathematics. All of which takes us back to a part of the definition with which we started, "it supposes as its basis the knowledge and discipline which general culture affords."

Only the last of these objections; namely, the lack of education in basic science and mathematics, will, at first thought, be charged to weakness in engineering college curricula and training, but there is a four fold responsibility involved in the making of an engineer which must be assumed jointly by the young man, his family, the college, and industry.

Engineering Offers High Living Standards

America, the land of opportunity, provides many avenues for rendering service and at the same time improving standards of living. Not the least of these are the engineering professions. Via engineering and the education provided by the engineering colleges, many men have reached social positions and attained economic rewards far better than those of the families from which they came. In fact, there are so few exceptions to this order of things, even among the poorer paid engineers, as to make perfectly valid some such declaration as: "Engineering is a profession through which the sons of small merchants, farmers, and laborers, as well as those of professional men and the prosperous in industry find golden opportunities to high living standards."

A large portion of the enrolled students in engineering colleges in part or entirely "work their way through." The author has, for more than a quarter of a century, cooperated with these men to make work, college courses, family budgets, and loan funds blend to the best advantage of all concerned. This blending process is not always easy, nor, though a certain amount of labor experience is desirable, is it advantageous for a student to be compelled to allot a very large part of his college time to earning money. In one college where the tuition is $300 per year and there are relatively few scholarships, one-sixth of the undergraduate student body and one-tenth of the graduate students are using National Youth Administration assistance. Nearly all the families to which these young men belong have incomes of $1,200 per year or less. According to the catalogue of the college in question, the minimum estimated cost per student for board and room, books, tuition, and so forth, but with no allowance for entertainment and clothing, is:

Students taking 21 meals in student houses per week. . . $840 per year

Students taking 15 meals (going home weekends)..... 740 per year
Nonresident students..... 390 per year

The cost per student in many free-tuition colleges, when all factors are considered is practically the same. If a family with an income of $1,200 per year (and there are those with less) must, with the aid of the student, apportion an amount equal to two-thirds the family income for the bare essentials of being in college, it is obvious there is little money available for travel, hotel life, theater, dances, and other social functions, or even for church activities, all of which have great bearing upon the phases of life which employers have declared are deficient in engineers to an extent which impairs engineering careers.

These deficiencies fortunately can all be remedied by any normal young man with capacity to complete an engineering course, if he is made aware of them, and will make an honest effort to know himself and apply the needed corrections. Keeping well is always simpler and better than curing illness, but continuing in illness is infinitely worse and sometimes inexcusable.

Being born and nurtured in an atmosphere of culture where all the graces of life are daily habits which can be acquired with little conscious effort has its advantages. When this experience has been denied the engineering students, colleges should provide clinics for correcting the deficiencies. Some of the more progressive engineering colleges have made progress in the right direction by having in their curricula a goodly proportion of cultural courses with the consequent necessity for postponement of the more special technical courses to graduate years. Industry also should not limit all its training courses for young engineers to the technique of the business, but should provide opportunity for them to learn of and correct faults which impair the rendering of the highest possible type of engineering service. College and industry together must show interest in our educational program from kindergarten on and co-operate with our engineering societies and the Engineers Council for Professional Development in extending their program for educating the public as to the requirements for being an engineer.

Industry should see to it that all who qualify as engineers be paid all the work done will warrant, and should not designate as engineering, work which is not engineering, but is only high-class clerical calculating, draughting, or skilled machine operation.

Engineers should make themselves thoroughly conversant and be sympathetic with all the problems of labor, skilled and unskilled, preferably through having had actual experience as workers in both classifications. They should not make entangling commitments to either capital or labor which may interfere with their great opportunities to correlate these two great industrial factors into teams that, working together at the business of applying engineering methods, cannot be defeated.

Fortunate indeed are the youths who find their talents and choices leading them into engineering; they can have a lot of fun following one of the many paths leading to enjoyable service for their fellow men, and at the same time providing so well a means of livelihood for themselves and their families.

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Voltage Distribution in the Welding Arc

A PAPER by H. von Conrady entitled "Investigation of the Voltage Distribution in the Welding Arc," which was published in *Elektroschweissung* (volume 8, June 1937, pages 101–06; July 1937, pages 125–28) recently has been translated by Herman J. Munz and is being distributed by the welding research committee of The Engineering Foundation. The author (1) describes apparatus devised as a part of a research subject under investigation at the experimental station for welding technique of the Technical University of Berlin, Germany, for measuring the voltage drop in welding arcs carrying currents as large as 1,000 amperes; and (2) presents results of tests made with that apparatus.

Electrodes made of iron, copper, and aluminum, all having diameters of 40 millimeters, were employed in the investigation. Test results showed that the arc characteristic for currents used in welding has a slowly increasing slope; in other words, the voltage increases with increasing current, assuming the length of the arc to be constant. Both the cathode voltage drop and the anode voltage drop are said to vary with the arc current.

The author found also that the voltage drop on the cathode is always larger than that on the anode, as should be expected in considering the energy regained on the anode. The magnitudes of the voltage drops, however, depend on the material used. For iron the voltage drop on the cathode is somewhat larger than that on the anode. The external shape of the unobstructed arc between iron electrodes was observed to be different from the shape of arcs between carbon, copper, or aluminum electrodes. Arcs between these latter materials graduate from a narrow limited point at the cathode in a cone-like shape to a wide base at the anode; however, the shape of the arc between iron electrodes is exactly reversed.

A few mimeographed copies of this translation are available from the Welding Research Committee, Engineering Foundation, 29 West 39th Street, New York, N. Y.

High-Voltage Gaseous and Fluorescent Tubes

High efficiency and wide variety of new colors may change the whole complexion of high-voltage applications

ALTHOUGH gaseous-discharge tubing (which usually is called simply "gaseous" tubing) had been used previously in the United States, the introduction of high-voltage neon and mercury tubes in 1924 inaugurated a new industry of such tremendous proportions that the whole aspect of outdoor electrical advertising was changed. The reasons for the wide acceptance of gaseous tubing were both functional and economic. By its use, advertising features could be outlined directly, thus offering better definition than by general floodlighting of those features. In addition, the life of the tubing was relatively longer, the installation requirements were simple, and attractively colored light could be produced more efficiently than from incandescent sources. Rapidly the gaseous tube assumed its role as a major feature of the nation's "white ways."

Filter Glasses and Basic Colors

The light emitted as a result of an electrical discharge in a gas gives a line spectrum, and by the use of filter glass some of the lines may be absorbed and others transmitted. Neon gives a series of lines, including yellow and red, the net physiological effect of which is the characteristic orange red. If the proper red tubing is employed, all but the deep red light is absorbed and a ruby tube is the result. Similarly, activated mercury vapor gives blue and green lines, which result in a whitish blue light. However, by using "novial" glass, which absorbs the blue lines, a green tube may be obtained. If the proper blue glass is employed, a so-called "midnight blue" tube will result. The use of helium in tubes was not found practical until 1933, when special electrodes to permit its use were introduced. Helium gives a yellowish white light and if a yellow filter tubing is employed, a gold effect can be obtained.

Elementary Use of Fluorescent Tubes

The first commercial fluorescent tubes employed uranium glass. By its use with a mercury discharge a green fluorescence was obtained; and this, combined with the filtering effect of the tubing, gave a blue green light at an efficiency somewhat higher than that obtained from "novial" glass. However, mercury tubes continued to play only a minor role, because neon tubes were relatively brighter, and attempts were made to improve the efficiency of mercury tubes. It was well known that at the gas pressures then used a large part of the energy emitted by the discharge was in the form of ultraviolet radiations that was not utilized.

In 1935 "Lumophor" tubing was introduced in the United States. In this tubing a fluorescent material was incorporated as an integral part of the glass walls of the tubing. A wide variety of colors was made available, including a yellow green, blue, gold, and a few shades of white. This development was important because it increased the efficiency of production of some colors and introduced others previously not available from any type of gaseous tubes. Green tubes, which were five times more efficient than nonfluorescent tubes, were produced. These new tubes found wide use in the sign industry, and the white tubes were used to some extent in interior decoration. Although "Lumophor" tubing represented an advance in the application of high-voltage gaseous tubes, it did not utilize all the ultraviolet light that was available. Too

Photo by Powers

White fluorescent high-voltage tubing was used to illuminate this glass dance floor. The attractive design of a marine compass was simulated by coating the underside of the glass slabs with colored translucent paint

or Advertising and Architectural Lighting

By J. A. McDERMOTT
ASSOCIATE AIEE

much of the ultraviolet energy was lost in reflection and absorption by the glass walls of the tubing.

Coated Fluorescent Tubes

One improvement was the introduction of a method of making fluorescent materials adhere to the interior walls of the tubing. With this construction the ultraviolet radiations impinged directly upon the material to be activated, and the reflection of the radiations by the interior surface of the tubing and their absorption by the glass had no effect upon the efficiency of the tube.

The efficiencies obtained by this method were revolutionary, and in the instance of green reached 60 lumens per watt. Moreover, many new colors were made available. Research promised the development of high-efficiency white shades, and a full range of pastels. However a great amount of ground work had to be done to reduce the laboratory samples to a practical basis. Fluorescent materials that best responded to the ultraviolet radiation emitted by low-pressure tubes were evolved next.

General practice in the sign industry had established the use of tubes having a life of from 3,000 to 10,000 hours and it was essential that during the major part of this period the luminescence be practically constant. Fluorescent tubes would have to possess similar characteristics, so that a section replaced because of breakage would not stand in too sharp a contrast to adjacent sections of a display.

Improvements in the technique of coating, evacuating, and processing the tubes, together with improvements in the phosphors, have resulted in high-voltage fluorescent tubes that meet all the rigid requirements. These tubes, known as "Zeon" tubes, have been introduced only recently to the American market.

Fluorescence has been obtained also where neon is used in the tubes without any mercury. A certain amount of ultraviolet radiation is emitted by low-pressure discharges in neon. A gold-colored tube is produced by using a material that gives a green fluorescence. The addition of the green light to the orange red of the neon gives a golden effect. By the use of other phosphors various neon fluorescent effects are obtainable.

Characteristics of "Zeon" Tubes

The efficiencies of high-voltage gaseous tubes are somewhat dependent upon the conditions of installation, lengths of tubes, diameters, operating currents, and for "Zeon" tubes, the point on the saturation curve at which the fluorescent coating is being activated. In general longer tubes have the highest efficiencies, because a large part of the power loss is incurred at the electrodes.

The following average efficiencies may be expected:

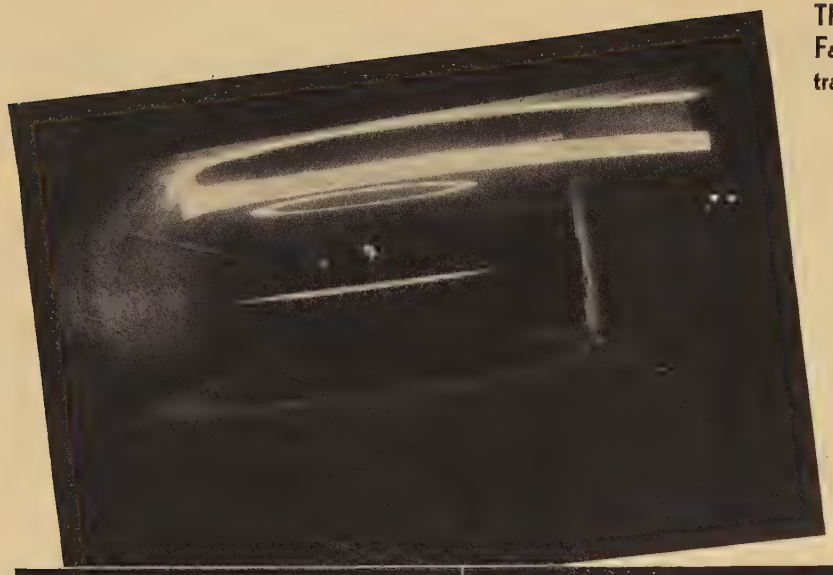
Blue—20–25 lumens per watt; mercury activated
Green—45–60 lumens per watt; mercury activated
Orchid—20–25 lumens per watt; mercury activated
Warm white—30–35 lumens per watt; mercury activated
Cold white—30–35 lumens per watt; mercury activated
Yellow—18–20 lumens per watt; mercury activated

Essential substance of a paper presented at the AIEE summer convention, Washington, D. C., June 20–24, 1938.

J. A. McDERMOTT is an engineer for Claude Neon Lights, Inc., New York, N. Y. He was graduated from Cooper Union Night School of Engineering in 1932 with the degree of bachelor of science in electrical engineering. Three years later he received the same degree from New York University. From 1928 until 1935 Mr. McDermott was employed as an engineer for Barr, Irons, and Lane, New York, and has been associated with Claude Neon Lights, Inc., for the last three years.

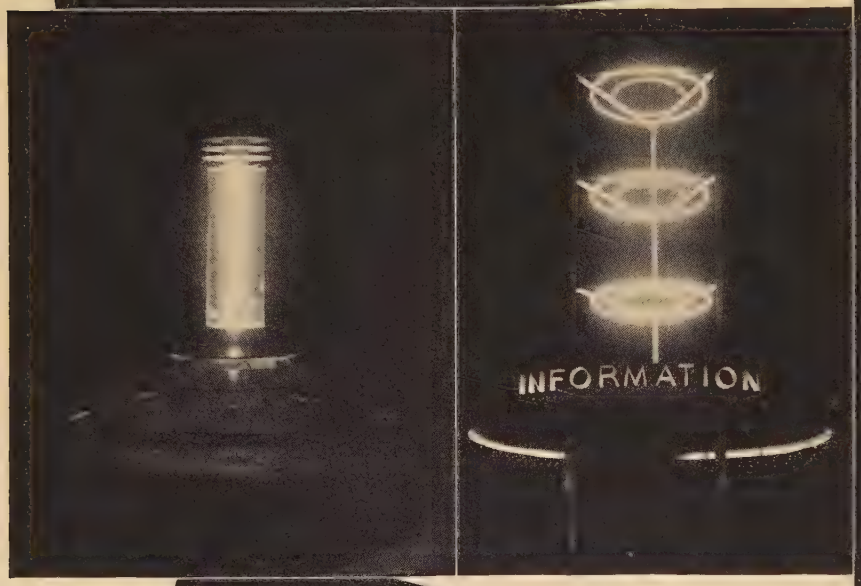
The author wishes to express his appreciation to Mr. Bassett Jones and the firm of Morgan, Hamel, and Engelken, illuminating engineers for the New York World's Fair 1939, for their co-operation in enabling the author to secure photographs of their designs.

The greatest display of high-voltage fluorescent tubes thus far was at the Paris Exposition of 1937. Many thousands of feet of tubing was used to obtain such colorful and spectacular displays as the lighting of the base of the Eiffel Tower



These "information" signs at the New York World's Fair 1939 are silhouetted against a background of translucent plastic material, which is illuminated from the back by blue fluorescent tubes

(Below) Serpentine tracery on pylons at the New York World's Fair 1939 produces a beautiful effect at night



(Middle left) "Aqualons" at the New York World's Fair will be illuminated by high-voltage blue tubing placed below the level of the water

(Center) Circles of blue and warm white tubing will provide general illumination around a booth, and a neon gold tube concealed in a reflector will give a golden glow to an "information" sign at the New York World's Fair

In this combination of architectural and advertising display lighting, lines of green fluorescent tubing were carried behind the joints of a glass-block wall. Vertical fluting on the interior surface of the blocks produces the effect of a multiplicity of tubes. Against the glass-block background is silhouetted a ruby-colored neon sign, the effectiveness of which is heightened by the complimentary value of the green background

Pink—15–20 lumens per watt; mercury activated
Gold—12–16 lumens per watt; neon activated
Salmon—12–16 lumens per watt; neon activated
Rose—12–16 lumens per watt; neon activated

A comparison between standard, nonfluorescent, gaseous tubes and the new fluorescent tubes reveal that the efficiencies have been increased by the following percentages:

Green—1,200 per cent
Gold—1,200 per cent
Blue—100 per cent

Comparisons of the other new colors with ordinary gaseous tube sources are useless because the new colors previously were not commercially obtainable in any form. A comparison of fluorescent tubes with incandescent sources for the production of colored light reveals the following increases in luminous efficiencies:

Green—4,000 per cent
Blue—3,000 per cent
Gold—100 per cent
White (warm)—250 per cent
White (cold)—350 per cent

The color of neon fluorescent tubes is dependent mostly upon the current, as the apparent color is a combination of the line spectrum of neon and the continuous but distributed spectrum of the fluorescent coating. The neon emission may be considered roughly as following a straight line at the lower values of current; however, the fluorescent material follows a saturation curve. For this reason, the color of any individual neon fluorescent tube changes from a hue associated with the fluorescent material to a reddish color as the current is increased. If the color is to be maintained, and higher tube currents are indicated as a means of increasing the light output, tubes having larger diameters must be used for neon fluorescence. In this way the balance between light from the neon spectrum and the light from fluorescent materials is maintained.

Winter Operation

Winter operation of high-voltage gaseous tubes always has presented some serious difficulties. Although neon tubes are not subject to any ill effects, cold weather causes a condensation in mercury tubes and a consequent dimming of the tubes.

For this reason, in the colder sections of the country the main features of signs always have been outlined in either helium or neon tubes. However, with mercury fluorescent tubes a multiplicity of colors will be available for practically all uses. Although cold weather causes a reduction of the light output, the intrinsic intensity is so high that the reduced light output is acceptable. Neon fluorescent tubes are not subject to any reduced efficiency in cold weather, and the new shades will broaden materially the choice of colors available.

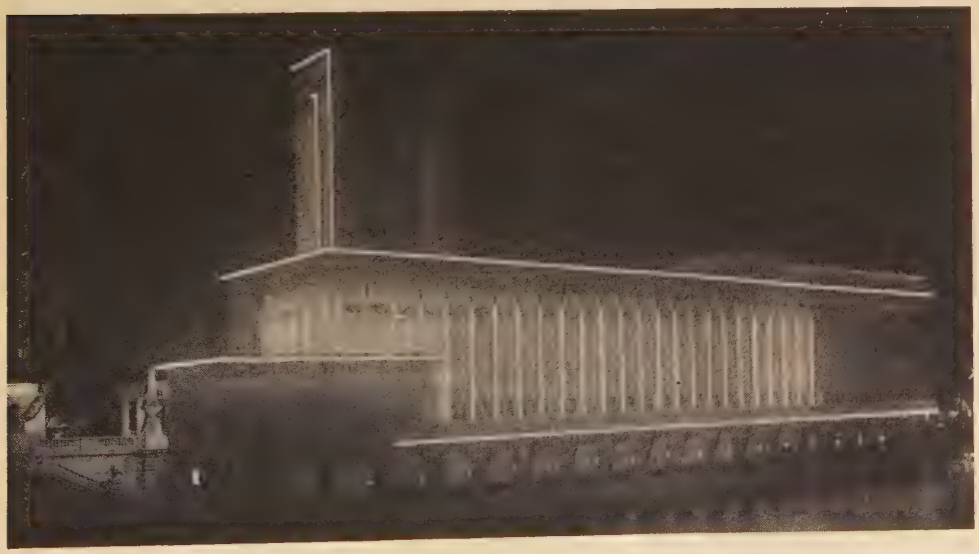
General Practice

Fluorescent tubes will be actuated by high-voltage high-reactance transformers, and the methods of connection and installation will be similar in general to those previously used in sign work. Transformer voltages may range from 1,000 to 15,000. Currents of from 12 milliamperes up to 500 milliamperes are anticipated. General practice will fall into a range of between 12 and 60 milliamperes. Standard transformers operate at a power factor of about 0.50, but transformers with the power factor corrected to over 0.90 by means of capacitors are obtainable.

Dimming may be accomplished by means of voltage-control devices in the primary circuits of the transformers, or by adjustable chokes. It is not possible to get a complete variation from full intensity to darkness. At the lowest point from 15 to 25 per cent of the light remains. It has been found, however, that this is not an inconvenient arrangement. The most common requirement for dimming is in theatrical work. In such locations, multiple colors also are required, and by proper adjustment certain colors or groups of tubes are switched out successively, so that gradual light diminution is effected. The best results are obtained when the tubes themselves are concealed, and all other installations must be designed with special care.

The neon fluorescent tubes previously discussed would change color with change in intensity and hence they would not lend themselves readily to dimming.

Fluorescent tubing will be available in diameters of from eight millimeters up to 35 millimeters. Power con-



Another spectacular display of fluorescent-tube lighting at the Paris Exposition of 1937 was the Radio Building

Without following the usual trend to red neon, an unusual effect was derived here from the use of a triple row of blue fluorescent tubes in a recessed-letter sign. The 12-millimeter tubing requires a current of 60 milliamperes

sumption will range from $^1/_2$ to 25 watts per foot of tubing, depending upon the current, diameter of the tubing, and whether the tube is designed for use in colder climates. Where cold weather is anticipated the fluorescent tubes are specially treated to give them such characteristics that temperature changes will have the least effect.

Color Combinations

It is desirable in many instances to obtain white by a combination of gaseous tubes of different colors. In this way multiple effects may be obtained, and if dimming devices are included in the system, numerous attractive variations will be available. In addition, the more efficient green tubes may be used. These are the possible combinations of tubing that will result in sensations of white light:

Combination	Result
Red (neon) regular—Green	Slightly deficient in blue
Gold—Pink	Pinkish amber
Green—Gold	Deficient in blue
Pink—Green	Good
Gold—Blue	Good
Red (neon)—Green—Blue	Offers wide range of hues

Application of "Zeon" Tubing

High-voltage fluorescent tubes already have found numerous uses, both in the United States and in Europe, including decorative as well as advertising lighting. In many instances fluorescent gold tubing has been substituted for helium gold. Such displays have resulted in energy savings up to 80 per cent. However, it is believed that "Zeon" tubes in general will not affect loads materially, because of the tendency to use higher intensities not available previously. "Zeon" tubing has been used also for the illumination of marquees. For such a use at the Hampshire House in New York City a neon gold tube was substituted for amber bulbs and an energy saving of 50 per cent was effected.

The greatest display of high-voltage tubes, up to the present time, was at the Paris Exposition of 1937. Literally miles of tubing was used to produce such spectacular effects as the lighting of the Eiffel Tower base and the radio building. In addition, several indoor lighting displays were used to good advantage. Typical of these was the Ford showroom.

The Future Uses of High-Voltage Gaseous Tubes

As the "World of Tomorrow," the preview of the New York World's Fair 1939 gives the beholder some idea of the architectural uses to which this new medium may be adapted. Serpentine tracery on the pylons gives a beautiful night-time effect. Tubes of one-inch diameter were used for this application. One hundred milliamperes flow through two rose-colored tubes and a current of 50 milliamperes is used for the green tubes. Blue fluorescent tubes behind a plastic result in an attractively illuminated silhouette sign operating with remarkable economy.

Circles of blue and warm white tubing provide general illumination around a booth, and a neon gold tube concealed in a reflector gives a golden glow to the information sign. The circles are of 18-millimeter tubing and operate at 60 milliamperes. The gold neon tube operates at 60 milliamperes and is 24 millimeters in diameter.

An outstanding night effect was obtained by placing high-voltage blue tubing below the water level in the "aqualons." This color is set into contrast by the gold tubes in the vertical cylinders above. Bubbles rising through the water produce a shimmering effect. These units provide general street illumination in their immediate area, in addition to their purely decorative features.

The applications mentioned represent only a few of the designs that have been completed by the World's Fair engineers, and it is certain that the New York World's Fair will develop many new uses of high-voltage fluorescent tubes and will serve as a true indication of future trends.

Typical of the indoor applications of high-voltage tubes at the Paris Exposition was the Ford display room

The Role of the Engineering Library

What Should It Contain and How Should It Be Used?

By HARRISON W. CRAVER

LIBRARIES are universally recognized to be essential to modern civilization. In a world that gets most of its learning through the printed word, storehouses of print are a vital necessity. In this regard engineering differs in no way from the other learned professions. Whenever we wish to extend our knowledge beyond our immediate environment, we turn directly to a library. Obviously, libraries are necessary elements of our colleges and universities. Two practical questions that arise are: How shall the library be formed, and how shall it be used?

In discussing these questions, I shall lean heavily on my own experience. Although the Engineering Societies Library is not a college library, its work is much the same. Its users are students from institutions where local facilities are inadequate, and engineers in practice or engaged in research work. Because of its unusual book collection, it is called upon to supplement the resources of many colleges, both in the United States and abroad, by supplying literature and bibliographical assistance. Its broad function, then, is to assist the student of engineering.

Until recent times, the library needs of the engineers have received rather scant attention. The physical sciences and engineering have not been adequately represented in any but the largest of our general libraries. In most colleges and universities, even those with substantial libraries, the provision for engineering has been below the level of that provided for other departments. Often it has been inadequate for any but the simplest needs.

Various reasons (or excuses) for this condition are given. One is that engineers in the past have not been bookish people. In the days when our profession was more of an art and less of a science than it is today, when each problem was solved through the results of past experience rather than by applying scientific principles, our literature was less helpful. Unless a closely parallel problem had been discussed, the seeker found little but broad generalities, most of which he already knew.

Another difficulty in the past was that the published works on engineering were written chiefly for use as college texts. Now the textbook has certain definite boundaries, fixed by the level of knowledge the student brings to the subject and the time available for presenting it. Taking account of the capacity of the average student, every author finds himself limited in the amount of ground he may cover, and he can deviate from the accepted pattern only by his method of presenting the basic information.

The books of the past, therefore, being either confined to fairly elementary fundamentals or else almost entirely descriptive, have not offered much attention to earnest students. In the last few decades, though, there has been a new tendency, and a better one.

The engineer of today, to an extent never realized in the past, is aware that his activities rest upon a scientific foundation. Just as the industrial chemist always has thought that the processes he employed followed the theoretical laws of chemistry, the engineer is coming to perceive that scientific principles form the basis of all his methods.

The results are apparent in almost every branch of engineering. In metallurgy, in hydraulics, in machine design, and in communications, to name only a few examples, we see marked advances that have resulted chiefly from the study of pure science.

Out of this development are coming books of a new type. Not intended for classroom use, they can deal with more limited fields and do so more comprehensively. Basing their treatment upon exact science, they insure longer useful life for themselves. The quality and durability of our engineering libraries are improving rapidly.

A third obstacle to the development of engineering libraries has been the lack of librarians with experience in engineering. Too few librarians, unfortunately, have come from scientific and technological studies, and brought to their duties an understanding of these subjects. Confronted with the flood of publications available, they have found it difficult to choose wisely.

Under these circumstances they have had a tendency to evade the problem and turn their attention to more congenial fields, to those where their scholarship was surer and their judgment sounder.

Past conditions, therefore, have been far from ideal. A literature that was limited in scope and largely elementary, and with custodians lacking the proper qualifications, did not conduce to the growth of strong libraries. As a consequence, the development of engineering libraries has been almost entirely a twentieth-century phenomenon. Today there are a number of libraries devoted to applied science, as well as numerous departments in colleges, universities, and large public libraries that offer a wealth of such material, adequately catalogued and administered by competent librarians.

Essential substance of an address "The Role of the Library in Engineering Education and Research" delivered upon the occasion of the inauguration of President O. C. Carmichael of Vanderbilt University, Nashville, Tenn., February 4, 1938.

HARRISON W. CRAVER since 1917 has been director of the Engineering Societies Library, an institution supported jointly by the national societies of civil, mining and metallurgical, mechanical, and electrical engineers, and housed in the Engineering Societies Building, New York, N. Y. He received the degree of bachelor of science from Rose Polytechnic Institute in 1895 and of doctor of science in 1933. During the early years of his career he was chemist successively for the following concerns: Kirkpatrick and Company, Schoenberger Steel Company, Duquesne Reduction Company, and Virginia Iron, Coal, and Coke Company. His library career began when he became technology librarian for the Carnegie Library of Pittsburgh in 1900. In 1902 he was assistant superintendent of the Allegheny Iron and Steel Company, but returned to the Carnegie Library of Pittsburgh in 1903 and became librarian in 1908, which position he held until his present appointment. He is a member of various technical and library societies, and is currently president of the American Library Association.

Their growth has paralleled that of our research institutions and has greatly facilitated research work. Thanks to them, it has become possible for the research worker to obtain access, in one way or another, to any published material on any subject, usually with little delay and at moderate expense. Bibliographic paraphernalia has been developed which is constantly making the literature more accessible, by providing information as to what is in print and where it can be found. New methods are being devised for copying and distributing what is needed. The change in conditions during the past 20 years can scarcely be described.

What Should a Library Contain?

Every library that I know (and every college, for that matter) suffers from lack of sufficient income to achieve its ideals. Engineering has been defined by Sir Frederick Bramwell as "the art of drawing sufficient conclusions from insufficient premises." Librarianship might be paraphrased as the art of collecting a sufficient library with insufficient funds. No library can afford to purchase everything. Probably no one would ever wish to do so. No library has ever achieved the ideal of cataloging and indexing. Neither has any library known to me been able to meet the multifarious needs and wishes of readers as fully as was desired.

The material of the library falls roughly into three categories: periodicals, books, and bibliographic equipment. Of these, the first is the most essential.

If the eighteenth century was the age of the pamphlet, and the nineteenth that of the book, the twentieth is the period of the periodical. Never before has there been such a quantity and variety of magazines and journals rushing from our presses.

In such fields of active development as science and technology they have pushed the book into the background. The strength of a research library can be measured today by the size of its periodical department. It is in the periodical that one looks to find the details of new discoveries and inventions, fresh from the discoverer's mind and in his own words. Here, too, are found those hints of new fields, suggestions of unexplored paths, that are the inspiration for further investigations.

Over the book, the periodical has certain definite advantages. It can discuss subjects that are either too detailed or too limited to justify a book. It can be more timely and less formal, and can discuss a subject as it develops day by day. In the future, even more than in the past, the periodical will be first to report new discoveries, and will form the source from which material for books and inspiration for further study are drawn.

The number of periodicals, however, is amazing and far beyond the purchasing power of any libraries but the largest. Probably more than 3,000 periodicals of some professional interest to engineers are now being published. In addition, there are hundreds that have ceased publication but are still of value, and new ones are appearing almost daily.

Fortunately, the usual requirements can be met by a relatively small number. Fifty periodicals probably will cover all general needs. Another fifty will be adequate for ordinary research work. Beyond this, material can be obtained as needed from other centers.

The selection of the most important periodicals is difficult. The needs and preferences of the selector are apt to influence choice unduly, and some more impersonal method is desirable. One such method, devised by P. L. K. and E. M. Gross, was described in *Science*, in 1927 (October 28 issue, pages 385–9) and illustrated by application to chemical periodicals. A few similar studies have been published, and more would be welcome. In their absence, selection must be based on the experience of other libraries with similar needs.

Complete sets of periodicals, while desirable, are by no means necessary. Most demands will be for the issues of only the last 25 or 30 years. Much money can be wasted in attempting to obtain the early volumes of older periodicals, without regard to the demand for them.

In spite of common opinion, books, as distinguished from periodicals, are of secondary importance in the engineering library. One reason for this, already mentioned, is the fact that our books are so largely written for use as undergraduate textbooks. Useful as these are for instruction and quick reference to fundamentals, it does not seem necessary to have many works that cover the same field with about the same comprehensiveness, and differ only in method of presentation. Two or three on a subject are usually adequate.

Another reason that lessens the importance of these books is that they always lag behind current knowledge and hence rapidly become too out of date to be very useful. Obsolescence occurs at a high rate, five years of useful life being perhaps a fair estimate. After that, most current books are either revised or supplanted by better ones.

The book collection in use at any time is therefore relatively small. Most needs can be met with remarkably few titles, say 4,000 or 5,000. Except for some classical works, these should be books of very recent publication, so that the factual information may be the latest available.

An active engineering library therefore might comprise 5,000 books and, perhaps, 2,500 volumes of some 50 periodicals. As new books appear, others are withdrawn. If it is desired to keep them, they can be retained as a supplementary collection, and this is desirable if space permits, for they sometimes will be wanted by the research worker or historian. But in beginning, these uses may be neglected and attention focussed on immediate requirements only.

Supplementing the books and periodicals, every library should have adequate bibliographic equipment. This consists of indexes, abstract journals, and bibliographies.

No library can have too many of those aids to research. The smaller the library is, the more important they are, for they provide guides to what has been published, and what is not available locally can usually be obtained, if its existence is known. Abstract journals also often supply all that is needed for ordinary purposes. In many cases they make it unnecessary to have the original periodicals and

so are an economy, in spite of their relatively high cost. Such publications as *Engineering Abstracts*, *Science Abstracts*, *Chemical Abstracts*, and *Metallurgical Abstracts* are fundamental necessities to every research library.

The number of abstracting services is large, and is increasing as our literature becomes more voluminous and complex. Considerable overlapping exists, but is not a cause for worry, as the abstracting and indexing vary with the different viewpoints of those for whom the services are intended. Although the ideal would be a single publication which abstracted and indexed everything from all points of view, that ideal never will be reached, or even approached, in our day.

These journals, together with such indexes as the *Engineering Index* and the *Industrial Arts Index*, and the national bibliographies of the leading countries, are the means through which any research problem is most easily approached.

How Is the Library Used Effectively?

Tedious as library research is, it indubitably is the proper first step in any investigation. No better means exists for ascertaining the extent to which any field has already been covered, the results obtained, and the points where further study is needed. Much time-consuming, expensive experimental work can be avoided through the library. Every experienced librarian can cite specific instances of work which was done twice, often at large expense, because through insufficient reading the first investigation was unknown to the later student. Large sums have been invested in patents that were overthrown by searching the literature at relatively small cost.

Assuming that we have acquired our library, a modest collection of perhaps 10,000 books and volumes of periodicals and index journals, how shall we use it effectively? Here we approach an art that each must learn for himself. Methods will vary with individual tastes and with the fields of study. There is no universally applicable technique, nor can any one lay down rules that appeal to every worker.

A good method is first to ascertain whether any comprehensive treatises exist, by examining the most comprehensive bibliographies available. As a preliminary, this treatise will serve as a summary of work prior to the date of publication, or approximately so. Often use of it will obviate the need for examining earlier periodical literature or, if it does not do so, will provide convenient references to the relative articles.

Subsequent to the date thus established, the first search is for bibliographies that will be helpful. Usually none can be found, or those found are suspiciously brief and incomplete. Except for those lucky occasions when a satisfactory bibliography is to be had, one may as well turn at once to the abstract journals and engineering indexes, compile his own list of references that offer promise, and obtain these by consulting the originals.

Proceeding in this way, one is enabled to cover the subject as thoroughly as the occasion requires or as time permits. Eventually, it is possible, or should be, to disinter everything that has been published. This, however, is seldom done and the "complete" bibliography is exceedingly rare.

As thus outlined, the searcher's method seems very simple. Actually, of course, complications arise that call for all his skill and knowledge. Indexing and classifying are arts that are far from perfect, and it often is difficult to trace the desired subject through all the vagaries of various workers.

In different indexes various names are used for the same things. Terminology changes from time to time. Articles that fall into one group when classified by a physicist sometimes are classified quite differently by an electrical engineer. Practically never does one index or abstract journal cover its field completely. In addition, indexes seldom go beyond the main subject of an article, and nothing but direct examination will discover the hidden information within it. All these difficulties arise to hamper the searcher, but if he is sufficiently persevering and industrious, he eventually will find what exists on his subject.

A search of any magnitude is almost sure to bring to light material not in the local library, which must be consulted elsewhere. In the past, this often has been difficult, if not impossible, as many libraries are unable to lend their possessions. Fortunately, modern methods of copying have developed to a stage where material can be copied cheaply and accurately. The use of the Photostat has spread rapidly in recent years, until most libraries can supply photographic copies. Very recently attention has been directed toward microcopying upon film, a method of great promise for the research worker. The "microfilm" method is especially valuable for reproducing long documents, such as complete books, more cheaply than was possible in the past. Some form of projector is necessary to produce a readable image, and a variety of apparatus is already available.

Through the development of bibliographic equipment which enables librarians to ascertain where given documents exist, and of good methods for reproducing them, the entire book resources of the world are rapidly becoming accessible to every worker, regardless of his location. Current tendencies undoubtedly will affect the management of the college library. No longer will it need to be considered as an isolated institution that must rely wholly on itself; instead, it may be considered as one of a system of co-operating organizations, with resources pooled to a certain degree. Intelligent use of the facilities available for obtaining seldom-wanted material through means other than direct purchase should release funds that can be used more effectively for ordinary needs.

An engineering library may be regarded as a laboratory. Like other laboratories, it is a place for study and research. Like them, its assets are personnel, equipment, and housing. Also like them these assets are important in the above order. A good librarian will get better results with meager equipment than a poor one can get with all the books in print. The best collection of books possible is desirable, but best and largest are not synonymous terms. Good housing is always an advantage, but to sacrifice books and personnel for a handsome building is a frequent mis-

take. After all, the Curies did their brilliant work in a shed, and many libraries are giving excellent service in poor quarters.

Because the library is an essential tool in research work today, and promises to become even more important hereafter, college students would profit immensely from more instruction in its use. Too many leave college with no idea of the technique of searching, and hence find themselves helpless when cut off from professional advice. If, from time to time, problems were assigned for solution in the library, instead of the laboratory, this might be corrected to a degree.

No better description of the role that the library can play in research is to be had than the remarks on the scientific use of literature in Wiedlein and Hamor's "Glances at Industrial Research:"

"The scientific use of literature, or, as it is technically termed, bibliochresis, has the pilotage of all scientific investigation. It has, in fact, the same relation to research as the latter has to management; it is the intelligence service of all orderly inquiry, the preparational agent of factual determination, the guide of experimental trial in eliminating chance, in the whole realm of science, whereby the sedulous worker his laboratory course does steer."

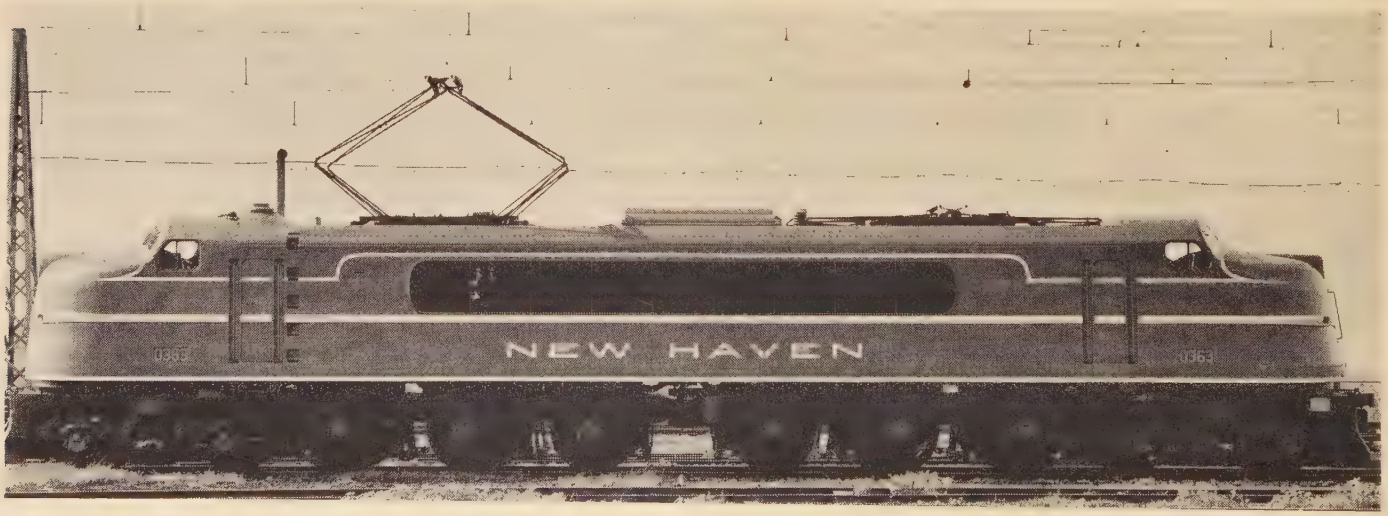
These distinguished research workers speak warmly of the necessity of a literature search as the prelude to experimental investigation. It prevents waste through needless repetition; it is also, they say, a necessary "discipline for the self-conceit of the researchful mind."

Electric Locomotives—1888 and 1938

Fifty years' progress in electric locomotives was shown recently to the public by the New York, New Haven and Hartford Railroad. Marking delivery of the first of six new streamlined single-phase locomotives for express passenger service, shown in an accompanying illustration, a train of eight locomotives representing freight and passenger types built from 1888 to 1938 was exhibited at various points on the system.

The freight locomotive of 1888, shown here as it was exhibited on a flat car, was built for the Ansonia, Derby and Birmingham Electric Line, and is said to have been the first electric freight locomotive in the United States. It operated on 500 volts and was capable of hauling 35 tons at less than ten miles an hour.

The new 3,600-horsepower passenger locomotives are expected to haul 1,200-ton trains at 80 miles per hour. They are equipped to run from a single-phase 11,000-volt overhead trolley, or 600-volt d-c third rail. Electropneumatically operated changeover switches are provided for adapting the traction motor circuits to either a-c or d-c operation. With a-c operation the six twin motors are connected two in a series with three groups in parallel; 20 main transformer steps are provided. Two motor combinations are used for d-c operation, one with all six motors in series and the other with two in series and three groups in parallel. Rated continuous a-c tractive effort is 24,200 pounds; continuous d-c tractive effort is 26,900 pounds. Total weight, fully loaded, is 432,000 pounds; total length is 77 feet.



News
Of Institute and Related Activities

Pacific Coast Convention Affords Vacation Opportunities

As announced in previous issues, the 1938 Pacific Coast convention of the AIEE will be held in Portland, Ore., August 9–12. At this time the scenic beauty of Oregon is usually at its best, and these dates have been selected to afford members and their guests the opportunity to combine vacation trips with attendance at the convention. The program includes six technical sessions, two student sessions, a golf tournament on the beautiful scenic course of the Oswego Lake Country Club, interesting inspection trips, and a variety of entertainment. Convention headquarters will be in the Multnomah Hotel.

Vacation Hints

Opportunities exist to visit a number of points of scenic and recreational interest. Many of Oregon's mountain lakes and streams abound with fish and provide some of the best fishing to be found in the country. Scenic points or routes which may be visited either as side trips or as part of the trip to Portland include: Crater Lake (Ore.); Oregon Caves; Oregon Coast Highway; Columbia River Highway; Mt. Hood (Ore.); Wallowa Mountains; Mt. Ranier (Wash.); Olympic Peninsula (Wash.); Coulee Dam (Wash.); Victoria, B. C., and Vancouver Island, B. C. The trips committee will be glad to assist in planning trips. A request to Vernon B. Wilfley, trips committee chairman, 914 Porter Building, Portland, Oregon, will bring the desired information.

Technical Sessions

Six technical sessions, including one joint communication session with the Institute of Radio Engineers, will present a variety of timely technical subject matter. Power transmission, particularly as related to several large western engineering projects, will be brought forth in several papers. One of the six sessions will be a symposium on the operation of the Boulder Dam transmission line. Another session, which will deal with power transmission and related subjects, includes a paper describing the pumping system of the Colorado River Aqueduct and another paper in this session treats the subject of phase-angle control of system interconnections.

Student Activities

The dinner and joint conference on student activities will be held on the evening of Tuesday, the opening day of the convention. All student delegates and counselors, as well as others interested in student activities, should attend this important event.

The two student technical sessions will be held on Wednesday and Thursday afternoons. All students are invited and expected to attend all convention activities, including technical sessions, entertainment, and inspection trips, as far as they are able.

Joint Session With IRE

The Pacific Coast meeting of the Institute of Radio Engineers will be held in Portland, August 10–12, with headquarters in the Multnomah Hotel. The AIEE will hold one joint technical session with the IRE. Members of either organization will be welcome at all technical sessions of both Institutes.

Entertainment

Social activities of the convention will begin with a brief informal reception on Tuesday evening to permit meeting the officers and their families and renew acquaintances. On Wednesday evening a buffet supper will be held at the Oswego Lake Country Club. The golf prizes will be presented and there will be an informal dance in an ideal summer setting. On Thursday evening a banquet will be held in the grand ballroom of the Multnomah Hotel, which will be followed by entertainment.

Convention headquarters in the Multnomah Hotel will be open Monday afternoon and evening to serve as a bureau of information for visiting members and friends, and Monday evening the reception committee will hold "open house" on the mezzanine floor.

Women's Entertainment

In addition to the foregoing entertainment the following events have been specially arranged for the visiting women. On Tuesday afternoon, 2:30 p.m., a tea will be held in a private residence on the heights overlooking the city of Portland and the Willamette River. In the evening no general dinner meeting or entertainment has been arranged, with the thought that the reception may lead to congenial, private dinner parties and a pleasant evening. Wednesday morning will be spent in shopping or visiting places of interest in and around Portland and the women on the reception committee will be available to assist when needed. In the afternoon a putting contest will be held on the putting green of the Oswego Lake Country Club. All contestants will be required to wear golf shoes. Those not wishing to participate in this contest may go boating or swimming. Thursday, 1:30 p.m., a bridge luncheon will be held at the Portland Golf Club.

A reception committee of local women will be at the registration desk to greet old friends, make new friends, and be of general assistance. Arrangements will be made for the care of children of the convention visitors, so that parents may attend scheduled events or inspection trips. Those planning

Schedule of Events

Tuesday, August 9

9:00 a.m.—Registration

10:00 a.m.—Opening of convention

10:15 a.m.—Address of welcome and response

10:30 a.m.—General session, including address by President-elect John C. Parker on "Engineering Orientation"

2:00 p.m.—Measurements and basic sciences session

Electrical machinery and protective devices session

6:00 p.m.—Reception

7:00 p.m.—Student-counselor dinner and conference (All interested in student activities welcome)

Wednesday, August 10

9:00 a.m.—Symposium on operation of Boulder Dam transmission line

2:00 p.m.—Student technical session

Golf at Oswego Lake Country Club, swimming and boating party, putting contest for ladies

7:00 p.m.—Buffet supper

9:00 p.m.—Orchestra, dancing, awarding of golf prizes, etc.

Thursday, August 11

9:00 a.m.—Communication—joint session with IRE

2:00 p.m.—Transmission and related subjects session

Student technical session

7:00 p.m.—Banquet at Multnomah Hotel, orchestra and entertainment

Friday, August 12

Choice of trips to Bonneville Dam, Ariel hydro plant, Oak Grove plant, Pacific Telephone Company plant, steam plants, 110-kv submarine cable crossing, underground systems, lumber and paper mills, etc.

A post-convention trip may be arranged to the new Timberline Lodge on Mt. Hood.

to bring their families are asked to notify the committee in advance.

Sports

Wednesday afternoon has been set aside for the annual golf tournament, which will be held at the Oswego Lake Country Club. This course, in addition to being considered one of the most beautiful and scenic in the whole country, will provide an excellent opportunity for golfers to prove their ability.

The principal contest will be for the Fisken Cup, now in the possession of Dean R. H. Dearborn of Oregon State College. This will be medal play, with full handicap allowance, and will be limited to AIEE members. Several other events have been arranged which are also open to nonmember guests upon the payment of an entrance fee. All players, members and nonmembers, are eligible to receive prizes with the single exception of the Fisken Cup. Many prizes for special achievements, such as long drives and closest approach, will be awarded. It is planned to have match play against par with full handicap and a blind bogey event in which each player is permitted to establish his own handicap.

If help is desired in arranging a foursome, please advise the sports committee as soon as possible so that satisfactory arrangements may be made. Arrangements may be made to start earlier than 2:00 p.m. As an alternative to the golf tournament, those attending the convention may join boating parties, swim in Lake Oswego, or take trips around the lake in a power launch.

Inspection Trips

One of the features of the convention will be a specially arranged trip to the Bonneville Dam project. The 40-mile drive to Bonneville is along the Oregon bank of the Columbia River on the famous Columbia River Highway, which passes Multnomah Falls and other well-known beauty spots. Guides will be provided at the power plant and ample time allowed for inspection of the project and the adjacent fish hatchery.

Other out-of-town trips may be arranged to the Ariel hydroelectric development and to the Oak Grove hydroelectric development, where the Northwestern Electric Company and the Portland General Electric Company, respectively, will act as hosts. Also trips may be arranged to any one of a number of nearby lumber and paper mills.

Among the local trips arranged are those to the Pacific Telephone and Telegraph Company's plant, the Northwestern Electric Company's 110-kv Columbia River submarine cable crossing, various steam plants of the power companies, and sight seeing trips in and around Portland.

Those passing through or visiting in Corvallis will find members of the electrical engineering department "at home" in Apperson Hall on the Oregon State College campus on Monday, August 8, and Saturday, August 13.

Registration

Members who plan to be in Portland preceding the convention should indicate that fact when returning their advance-registration card, as the reception and trips committees would welcome the opportunity of

Tentative Technical Program

Photo-offset copies of authors' mauuscripts, exclusive of addresses, may be obtained in advance of the convention by writing to the AIEE Order Department, 33 West 39th Street, New York, N. Y. Only numbered papers will be available in advance copy form. If ordered by mail, price 10¢ per copy; if purchased at Institute headquarters or at the convention, price 5¢ per copy. Coupon books in $1.00 and $5.00 denominations are available for those who wish to avoid remittance by check or otherwise. Most of the papers ultimately will be published in Electrical Engineering or the Transactions.

Tuesday, August 9

10:30 a.m.—General Session

Address: Engineering Orientation, **John C. Parker,** AIEE president-elect.

Address: The Atom Smasher, **A. W. Copley,** Westinghouse Electric and Manufacturing Company.

99. Selection and Design of the Electrification of the San Francisco-Oakland Bay Bridge Railway, **W. P. Monroe,** consulting engineer.

100. Trends in the Design and Arrangement of Electrical Equipment in Hydraulic Power Plants, **C. C. Whelchel,** General Electric Company.

2:00 p.m.—Measurements and Basic Sciences

101. Polarity Limits of the Sphere Gap, **F. O. McMillan,** Oregon State College.

102. Use of Bismuth Bridge Magnetic Flux Meter for A-C Fields, **G. S. Smith,** University of Washington.

103. A Variable Register Ratio Watt-Hour Meter, **G. R. Shuck,** University of Washington.

104. Similitude of Critical Conditions in Ferroresonant Circuits, **W. T. Thomson,** Kansas State College of Agriculture and Applied Science.

2:00 p.m.—Electrical Machinery and Protective Devices

105. Application of Copper-Oxide Rectifiers, **E. W. Morris,** Westinghouse Electric and Manufacturing Company.

106. Self-Excitation of Induction Motors, **C. F. Wagner,** Westinghouse Electric and Manufacturing Company.

107. An Application of Deceleration Test Methods to the Determination of Induction Motor Performance, **R. W. Ager,** University of California.

108. Static Power Limits of Synchronous Machines, **C. F. Dalziel,** University of California.

43. Testing and Application of Lightning Arresters, Lightning arrester subcommittee.

Wednesday, August 10

9:00 a.m.—Symposium on Operation of Boulder Dam Transmission Line

109. General Operation of Transmission Line, **W. S. Peterson,** Bureau of Power and Light, City of Los Angeles.

110. Corona Experience on Transmission Line, **Bradley Cozzens** and **W. S. Peterson,** Department of Water and Power, City of Los Angeles.

111. Insulation and Lightning Protection, **Bradley Cozzens,** Department of Water and Power, City of Los Angeles.

112. Carrier Current Equipment, **J. D. Laughlin,** Bureau of Power and Light, City of Los Angeles.

113. Transmission Line Relay Protection, **L. L. Draper,** Bureau of Power and Light, City of Los Angeles.

Thursday, August 11

9:00 a.m.—Communication—Joint Session With IRE

114. Narrow Band Transmission System for Animated Line Images, **A. M. Skellett,** Bell Telephone Laboratories, Inc.

115. Devices for Controlling Amplitude Characteristics of Telephone Signals, **A. C. Norwine,** Bell Telephone Laboratories, Inc.

Loud Speaker Considerations in Feedback Amplifiers (IRE paper), **H. S. Knowles,** Jensen Manufacturing Company.

Some Developments and Problems of Demountable Tube Design (IRE paper), **C. V. Litton,** Engineering Laboratories.

Practical Application of Facsimile Broadcasting (IRE paper), **H. C. Singleton,** Radio Stations KGW and KEX.

2:00 p.m.—Transmission and Related Subjects

116. The Pumping System of the Colorado River Aqueduct, **J. M. Gaylord,** The Metropolitan Water District of Southern California.

117. The Electrical Strength of Air at High Pressure, **H. H. Skilling,** Stanford University.

118. Phase Angle Control of System Interconnections, **R. E. Pierce,** Ebasco Services, Inc., and **B. W. Hamilton,** The Montana Power Company.

119. The Electrostatic Unbalance of Transmission Lines and Its Effect on the Application of Petersen Coils, **J. A. M. Lyon,** Saginaw, Mich.

meeting with, and furnishing suggestions for trips to, all early arrivals.

Registration may be completed upon arrival at Multnomah Hotel, headquarters, Monday evening, August 8, and should be completed, if possible, before 10:00 a.m. Tuesday. A registration fee of $2.00 will be charged all nonmembers, except Enrolled Students and the immediate families of members.

Hotel Rates

The rates of the Multnomah Hotel, convention headquarters, as well as those of some of the other hotels are listed in an accompanying tabulation. Members should make their hotel reservations by writing directly to the hotel of their preference. The Multnomah offers a special rate for students (several per room) of $1.50 per person per day.

One of the greens on the scenic and sporty Oswego Lake Country Club's course, where the golf tournament will be held at the AIEE Pacific Coast convention. Lake Oswego and Mount Hood may be seen in the background

Committees

The personnel of the 1938 Pacific Coast convention committee is as follows: General committee—E. F. Pearson, *chairman;* D. F. Smith, *vice-chairman;* Corbett McLean, *secretary;* John Bankus, *treasurer;* C. Arnott, A. M. Bohnert, C. C. Boozier, R. O. Brosemer, H. V. Carpenter, A. W. Copley, L. G. Fear, W. F. Grimes, M. F. Hatch, N. B. Hinson, C. H. Hoge, J. P. Jollyman, O. L. LeFever, F. M. Lewis, C. E. Magnusson, W. S. McCrea, F. O. McMillan, H. L. Melvin, L. T. Merwin, G. W. Miller, A. S. Moody, H. S. Osborne, E. F. Peterson, A. C. Pratt, R. W. Preston, G. E. Quinan, C. E. Rogers, M. A. Sawyer, E. F. Scattergood, H. H. Schoolfield, H. H. Skilling, G. H. Smith, R. W. Sorensen, A. LeRoy Taylor, A. Vilstrup, and C. A. Wolfrom. Chairmen of subcommittees—O. B. Coldwell, *finance;* Walter Brenton, *program;* Sidney E. Caldwell, *registration;* R. J. Davidson, *hotel;* Vernon B. Wilfley, *trips;* Charles B. Carpenter, *publicity;* L. R. Elder, *reception;* A. H. Kreul, *entertainment;* J. C. Henkle, *golf;* Mrs. J. F. Spease, *women's entertainment;* A. L. Albert, *student activities;* and Gwynn E. Bishop, *transportation.*

Principal Hotels in Portland, Ore., and Rates

Hotel	City Blocks from Headquarters	Single Room With Bath	Double Room With Bath
Multnomah	0	$2.50 to 8.00	$3.50 to 10.00
Benson	4	3.00 to 7.00	4.50 to 10.00
Heathman	12	2.50 to 6.00	3.50 to 7.50
Portland	8	3.50 to 5.00	5.00 to 7.00

Future AIEE Meetings

Pacific Coast Convention
Portland, Ore., August 9–12, 1938

Southern District Meeting
Miami, Fla., November 28–30, 1938

Winter Convention
New York, N. Y., January 23–27, 1939

South West District Meeting
Houston, Texas, Spring, 1939

North Eastern District Meeting
Springfield, Mass., May, 1939

Summer and Pacific Coast Convention (combined)
San Francisco, Calif., June 26–30, 1939

Additions to Member-for-Life List

Membership for life is granted by the Institute for either of the following two reasons: a member has paid annual dues for 35 years; or has reached the age of 70 and has paid dues for 30 years.

Those who have become members for life during the preceding year are listed annually in Electrical Engineering. The list that follows indicates those members who have become members for life since the publication of the last preceding list in the June 1937 issue:

H. C. Abell
W. P. Abendroth
J. G. Barry
Paul L. Battey
W. H. Beattys, Jr.
Leon Beauchamp
C. A. Bessey
H. M. Beugler
W. L. Bird
S. H. Blake
C. E. Bonine
R. B. Bonney
J. E. Brown
W. H. Browne, Jr.
J. A. Brundige
C. I. Burkholder
W. G. Burns
Edmund G. Burr
L. M. Cargo
W. M. Carlebach
H. V. Carpenter
Markham Cheever
H. P. Clausen
F. W. Clements
F. H. Clough
C. B. Coates
S. K. Colby
G. P. Cole
C. W. Comstock
A. L. Cook
C. A. Cora
A. S. Crane
J. A. Cranston
J. R. Crocker
H. P. Daniels
J. H. Davis
W. F. Dawson
W. F. Dean
M. E. de Marchena
E. L. Doty
J. C. Dow
H. Dowie
C. G. Durfee
L. L. Elden
F. M. Farmer
E. M. Fitz
T. J. Fleming
J. T. Flickinger
F. F. Fowle
M. M. Fowler
A. A. Frank
E. V. French
L. B Fuller
E. M. Gerry
C. F. Gilcrest
E. H. Ginn
J. G. Glassco
C. D. Gray
L. D. Gray
D. Hall
H. C. Hall
H. Y. Hall
M. R. Hanna
P. T. Hanscom
H. R. Harper
James Harrison
G. A. Harvey
L. A. Hawkins
J. E. Hayes
R. H. Henderson
H. H. Hess
A. C. Hobble
C. A. Hobein
E. Holcomb
E. B. Holden, Jr.
H. A. Holdredge
H. M. Hope
R. S. Hopkins
W. S. Hunt
A. Hussey
W. C. Jessup
F. B. Jewett
J. C. Johnson
G. H. Jones
W. S. Kelley
C. B. Keyes
J. B. Klumpp
G. S. Laing
A. S. Langsdorf
A. H. Lawton
J. E. Lear
C. Le Grand
G. Lobo
J. E. MacDonald
W. L. Mann
R. H. Manson
W. C. Marlow
L. G. Martin
W. S. Wyman
Ross B. Mateer
Howard Maxwell
M. C. McKay
N. C. McPherson
P. S Millar
A. A. Miller
A. H. Moraweck
C. T. Mordock
C. H. Moritz
W. S. Murray
W. G. Nagel
R. J. Naucler
J. B. Noe
H. H. Norris
T. A. Panter
K. A. Pauly
H. C. Pease
R. B. W. Peck
H. A. Perkins
J. H. Perkins
C. L. Perry
G. W. Pickard
G. A. Pierce, Jr.
H. T. Plumb
A. C. Pratt
G. R. Radley
K. C. Randall
O. M. Rau
C. E. Roehl
A. F. Rolf
B. P. Rowe
S. W. Rushmore
M. C. Rypinski
P. C. Saccaggio
H. W. Scharf
M. Schreiber
F. F. Schuetz
A. K. Selden, Jr.
F. L. Sessions
Robert Sibley
Arthur Simon
E. H. Smythe
T. H. Soren
L. B. Spinney
S. D. Sprong
O. C. Spurling
H. B. Stabler
A. L. Stadermann
N. R. Stansel
Robert Steck
G. H. Stickney
J. F. Stockwell
Edgar Strasburger
J. B. Taylor
A. H. Timmerman
M. S. Towson
C. R. Underhill
L. E. Underwood
R. W. Van Norden
C. H. Van Slyck
J. F. Vaughan
W. N. Voorhees
J. A. Walls
H. M. Warren
H. S. Warren
S. B. Way
J. Lloyd Wayne, 3rd
G. E. Wells
F. S. Wilhoit
F. T. Wright

Lenox, Mass., Scene of District Meeting and Student Convention

A PROFITABLE and especially pleasant period was enjoyed by the 400-odd persons who attended the AIEE North Eastern District meeting at Lenox, Mass., May 18–20. Ideal is the only word adequately describing the housing, meeting, and other facilities provided by the local meeting committee, which arranged with the management of the Curtis Hotel to advance the date of seasonal opening to accommodate the meeting and, in effect, to turn over the entire facilities of the spacious building to those attending.

The three-day meeting entered promptly into its business with the first technical session immediately following registration Wednesday morning; the second technical session Wednesday afternoon. Thursday morning was devoted to a general session, and Thursday afternoon to inspection trips. Two student sessions were held Friday, the afternoon session in parallel with the concluding technical session. Major social events included a stag smoker for the men, and bridge tournament for the women Wednesday evening and a mixed banquet addressed by Past Vice-President W. H. Timbie Thursday evening. This sequence of activity worked out smoothly and apparently to everyone's satisfaction. Details are reported on this on the following pages. Attendance figures are given in an accompanying tabulation.

Analysis of Registration at Lenox Meeting

Classification	Location: Pittsfield Section	Location: District 1*	Location: Other Districts	Totals
Members	109	106	18	233
Students	9	106	19	134
Men guests	3	19	6	28
Women guests	4	13	5	22
Totals	125	244	48	417

*Outside of Pittsfield.

Doctor Darrow and Roger Babson Speak

The general session Thursday morning was opened by Chairman K. B. McEachron of the District meeting committee who turned the gavel over to Past-President C. C. Chesney as chairman of the session. Appropriate introductory remarks were made in turn by Chairman Aram Boyajian of the Pittsfield Section, General Electric Pittsfield Plant Manager L. E. Underwood, Vice-President A. C. Stevens, and National Secretary H. H. Henline speaking on behalf of President W. H. Harrison who then was on his way from a tour of official visits in the Middle West.

Doctor Karl K. Darrow, renowned physicist of the Bell Telephone Laboratories of New York City, lectured on the subject of "Radioactivity—Artificial and Natural." The full text of this address may be found beginning on page 193 of the current May issue of ELECTRICAL ENGINEERING.

Roger W. Babson, widely known statistician, and assistant secretary of labor in the cabinet of Woodrow Wilson during the World War chatted with his audience on the theme "If I Were President of the United States." As "one fundamental necessity in the correction of evils of the present era," Mr. Babson recommended that "wages be so equalized as to make life in cities so unpleasant for some people that they will go back to the farm." In speaking further of wages, he emphasized that "wages cannot exceed the aggregate value of the products of labor, and should be distributed to individuals only in accordance with the proportion of individual contribution in products, efficiency, etc., and not in accord with artificial bases set up by law.... Prices and wage levels are inseparably related by economic laws, and to legislate higher prices or wages can only upset and aggravate the situation. . . the standard of living can be raised only through boosting total production; never by curtailing it—neither can it be raised by subsidizing an inefficient industry at the expense of those that are better managed."

Mr. Babson urged the necessity for "catching up spiritually with our advanced stage of material development," giving emphasis to this by the following comparisons: "Our political power has been increased 100 per cent—by the women's vote; our power to travel has been increased 500 per cent—by air, water, road, and rail; our power to see has been magnified 1,000 per cent—by the motion picture; our power to hear has been increased by 10,000 per cent—by the radio; but how much has our judgment, self-control, self-dependence, and recognition of our public responsibility increased?" He expressed the belief that "the churches of all denominations are the basic hope of America today."

Distribution Voltage Regulation

Reflecting experiences of operating companies and touching upon various phases of the problem of voltage regulation on distribution circuits, with special emphasis on the problems incident to the extension and development of rural electric service, were the following four papers which are scheduled for publication in the TRANSACTIONS section of ELECTRICAL ENGINEERING for September:

SYSTEM PLANNING AND OPERATION FOR VOLTAGE CONTROL, **T. J. Brosnan,** Buffalo, Niagara and Eastern Power Corporation.

VOLTAGE-REGULATING-EQUIPMENT CHARACTERISTICS AS A GUIDE TO APPLICATION, **P. E. Benner** and **G. S. Lunge,** General Electric Company.

VOLTAGE REGULATION AND CONTROL IN THE DEVELOPMENT OF A RURAL DISTRIBUTION SYSTEM, **G. H. Landis,** Central Hudson Gas and Electric Corporation.

THE PERIODIC VOLTAGE SURVEY AS A BASIS FOR DISTRIBUTION DESIGN, **R. W. Burrell,** Consolidated Edison Company of New York, Inc., and **W. E. Appleton,** New York and Queens Electric Light and Power Company.

For the purpose of contributing to local discussion, Mr. Brosnan described the practices of the Buffalo, Niagara and Eastern Power Corporation in the matter of voltage control, without attempting to go deeply into supporting material or to make any comparisons of practices followed by other companies. With reference to the characteristics of new load currently being added to distribution systems, Mr. Brosnan emphasized as disturbing points the low power factor and tendency toward rapid load changes, recommending co-operation between electrical manufacturers, electrical contractors, and electric power companies "to insure the proper operation of utilization equipment without interfering with other loads and at the lowest over-all cost to the industry." He recommended as a step in such a co-operative program that power companies should introduce reasonable limitations on motor-starting currents "based on the true capacity of the distribution systems to accommodate such currents without serious voltage disturbance, in place of limitations based on size of motor. He also emphasized the obvious relationship between proper voltage regulation and customer satisfaction.

A brief summary of the characteristics of

Some of those present at the Lenox meeting; left to right: Director K. B. McEachron, chairman of the District meeting committee; H. S. Knowlton of Boston, Mass.; National Secretary H. H. Henline of New York, N. Y.; W. H. Timbie, chairman of the Sections committee, of Cambridge, Mass.; Vice-President A. C. Stevens of Schenectady, N. Y.; C. S. Rich, secretary of the technical program committee, of New York; Aram Boyajian, chairman of the Pittsfield Section; and C. A. Read, publicity subcommittee chairman of the District meeting committee

a wide variety of different regulating devices, and a comparison of their suitability for various applications from the manufacturer's viewpoint was presented by Messrs. Benner and Lunge of the General Electric Company. It was their contention that "the majority of systems need both generator voltage regulators and suitable feeder regulators, if maximum ease, efficiency, and flexibility of system operation are desired. Proper choice and adjustment of the voltage-responsive controlling elements of such regulating equipment will insure harmonious functioning of the regulators throughout the system, without hunting between regulators of different construction."

The rapid growth of rural electrification and the importance of maximum service continuity commensurate with economical expenditures has given impetus to the study of means to provide a sati factory solution, according to Mr. Landis, who described the development of a rural network system in the territory of the Central Hudson Gas and Electric system. He also described methods for obtaining a constant check of voltage conditions throughout a rural area, and stated that the selection of voltage rating for rural lines often is dependent upon operating conditions peculiar to the area served. He expressed the conviction that "with the equipment now available, voltage can be regulated accurately over substantially long lines at reasonable cost, and frequently major expenditures for reinforcement can be deferred for long periods by the proper application of regulating equipment." For many cases of temporary relief he considered the field for application of step regulators to be large because of their low installation cost. Except for unusual conditions, he found little to say in favor of either shunt or series capacitors. He emphasized that rural electrification still is in its infancy with respect to electric power utilization, and "requires continual and careful study in checking of load growth, circuit balance, and voltage regulation to the end of producing greater satisfaction among its users."

Methods of conducting systematic voltage distribution surveys were described by Messrs. Burrell and Appleton, reflecting the practice of the Consolidated Edison Company of New York and the New York and Queens Electric Light and Power Company. Brief reference was made to methods of analysis and application of survey data. The authors consider that a detailed voltage survey need not be made every year; that as voltage conditions are improved a complete survey may be necessary only every two or three years and susceptible of application to different parts of the system in different years. They consider that readings from the systematic voltage survey, "appropriately taken and carefully analyzed, provide the engineering justification for redesign of the distribution system to correct existing unsatisfactory voltage conditions. The periodic survey data, by revealing trends of regulation, make it possible in planning system changes to anticipate unsatisfactory conditions before service voltages actually fall outside the accepted standards of good service. The broad view obtained of system voltage conditions facilitates the consideration of various plans proposed, and is a helpful guide in considering the necessity for general system reinforcement and improvement projects." As between indicating and graphic instruments for such a survey, graphic instruments were favored in studies of rural line voltages and indicating instruments were considered to be "the answer" to voltage survey problems of urban areas. To accommodate conditions arising from shifting load centers, the compensated type of step regulators were considered preferable.

Industrial Application

Representative of the broadening interest in and importance of the increasing penetration of electrical devices into modern industry, were the following four papers which are scheduled for publication in the TRANSACTIONS section of ELECTRICAL ENGINEERING for September:

REGENERATIVE TENSION CONTROL FOR PAPER WINDERS, **H. W. Rogers,** General Electric Company

COMPARISON OF METHODS OF STOPPING SQUIRREL-CAGE INDUCTION MOTORS, **W. I. Bendz,** Westinghouse Electric and Manufacturing Company.

THE APPLICATION OF CAPACITORS FOR POWER-FACTOR CORRECTION IN INDUSTRIAL PLANTS, **C. E. H. von Sothen,** General Electric Company.

PHOTOELECTRIC WEFT-STRAIGHTENER CONTROL, **C. W. LaPierre** and **A. P. Mansfield,** General Electric Company.

Generous in its content of specific operating data of importance to application engineers in the paper mill field was Mr. Rogers' paper descriptive of methods and equipment for meeting the exacting requirements of automatically controlled paper winders. The idea of regenerative tension control is not new, but modernization of the paper industry has stimulated changes and development to meet ever more exacting conditions of operation. This paper also serves to emphasize, quite incidentally, the extent of the needs and possibilities for modern application engineering in other industries such as textile and rubber.

T. H. Morgan of Worcester, Mass., presided at the industrial-applications session

In his comparison of methods of stopping squirrel-cage induction motors, Mr. Bendz presented actual test data in support of his several analyses and detailed conclusions. Each in its turn, he analyzed for different applications the relative advantages of (a) magnetically operated friction braking, (b) plugging, (c) dynamic braking through the application of direct current to one or more of the phase windings of the motor stator, and (d) dynamic braking through the use of a capacitor and resistor in which case the motor functions as an induction generator. Detailed recommendations given should be of special interest to application engineers in the machine tool field. Although test data is limited to motors of ten horsepower or less, the similarity of characteristics of motors up to 40 horsepower or so would permit an extension in the application of data given.

Touching on both the technical and the

Membership—

Mr. Institute Member:

During the past fiscal membership year, 44 out of every 100 applications for membership were obtained from Enrolled Students who desired to become Associate members in the Institute.

This large enrollment of young engineers represents a healthy situation in the Institute affairs. It also offers tangible evidence of the benefits which the Students have received from their Institute associations in the college Branches.

By taking advantage of the liberal policy which the Board of Directors has established for Students desiring to transfer to the Associate grade, these young engineers are enabled to acquaint themselves early with the other members of the electrical profession. Such associations are particularly beneficial to the Section membership and point out the need for close co-operation between Sections and college Branches.

A membership proposal form appears on page 14 of the advertising section of this issue

John Bankus

Vice-Chairman, District No. 9,
National Membership Committee

economic aspects of power-factor correction in industrial plants, Mr. von Sothen described methods of making corrective applications of capacitors. Here again was presented information of especial value to industrial and application engineers. The author gave solutions in some detail for three typical problems involving different energy requirements and rate bases. Discussion brought out the importance in connection with industrial power-factor correction, of giving careful attention to the character of the load of the particular plant, and also of considering future as well as current plant requirements.

In the development of textile machinery and manufacturing methods, the practical operating speed of textile machinery has gone far above the level at which it is possible for human eyes to follow the weave and for human hands to effect the necessary operating control. To the vast improvement of mill efficiency and product quality, the application of photoelectric control equipment, is spreading widely and rapidly. In their description of the photoelectric weft-straightener control, Messrs. LaPierre and Mansfield lucidly described equipment and its operation through which a uniformly square weave with its inherently improved distribution of stresses is obtained. The photoelectric initiating device operates on the scanning principle suggestive of the system used in television.

Transformers—A-C and D-C

Three papers pertained to various transformer problems:

Corona Voltages of Typical Transformer Insulations Under Oil—II, **F. J. Vogel,** Westinghouse Electric and Manufacturing Company.

New Types of D-C Transformers, **C. C. Herskind,** General Electric Company.

A D-C Transformer, **T. C. Lennox** and **E. V. DeBlieux,** General Electric Company.

These are scheduled for publication in the Transactions section of Electrical Engineering for September.

Referring to earlier work, and especially to that of Doctor L. Dreyfus concerning the matter of transformer insulation design, Mr. Vogel presented experimental data for air and oil and for insulation combinations in oil. Citing that Dreyfus had "assumed that electrical breakdown adjacent to square edges was a function of the stress and the distance over which the stress acted; in other words, that it was a function of the voltage gradient along a line of force for some indeterminate distance, "Mr. Vogel concluded that the work of Dreyfus and the tests reported in his own paper "both show that the arrangement of the insulation at the corners of transformer windings is of great importance to the designer, and that to obtain the greatest strength the area under greatest stress must obviously be free from air. If this condition is obtained, consistent test agreement with the theory for square corners can be obtained, and so-called 'form factors' can be developed for design purposes. Experimental data for one reference condition can be derived which will be useful in general applications, and with 'form factors' it is unnecessary to make countless other tests for every variation in design proportions."

Two different approaches to the problem of accomplishing direct-current transformation were reflected in the papers by Lennox and DeBlieux and by C. C. Herskind. Lennox and DeBlieux described the design of an experimental mechanical commutator for the purpose of transforming direct current from one voltage to another. In effect the experimental device comprised a primary commutator, an intermediate six-phase transformer with static capacitators to control excitation and commutation, and a secondary commutator. The two major cummutator problems were stated as being current collection and commutation. On the basis of experience with the experimental equipment, the authors concluded that "circuit constants and difficulties in mechanical construction have been fairly well explored . . . and the data obtained should be of value in connection with new projects." Experimental developments included a 300-kw 3,000-volt commutator equipment, the underlying motivation for which was a possibility of its application to street railway service to enable a street car to be operated within a city on a 600-volt trolley and to be operated between cities on a 2,400 or 3,000-volt trolley by simply throwing the d-c transformer in or out of the circuit.

Mr. Herskind described the experimental development of both constant-current and constant-potential d-c transformers, using grid-controlled mercury-arc rectifiers. Problems incident to commutation and sequence of circuits are met through the use of the rectifier tubes in place of the mechanical commutator previously mentioned.

A group of students who presented papers at student sessions of the Lenox meeting, left to right: J. T. Bradbury, E. G. Schroeder, Cromwell McIntosh, Jr., D. P. Lacock, R. P. Boyer, Jr., Shepard Roberts, H. B. Abajian, and District Student Chairman F. N. Tompkins

Lightning

Lightning and related phenomena were treated in two papers scheduled for publication in the Transactions section of Electrical Engineering for September:

Multiple Lightning Strokes—II, **K. B. McEachron,** General Electric Company.

Protector-Tube Application and Performance on 132-Kv Transmission Lines—II, **Philip Sporn** and **I. W. Gross,** American Gas and Electric Service Corporation.

Mentioning multiple lightning strokes as having been defined as "a succession of discharges in substantially the same path," Mr. McEachron analyzed the results of some 295 records obtained through the operation of a specially designed oscillograph on the lines of the American Gas and Electric Company at Roanoke, Va. Records seem to indicate that certain storms produce few if any multiple strokes, whereas other storms appear to average about an equal number of single and multiple strokes. As a result of his analyses, Mr. McEachron emphasized that protective equipment should be applied in the light of knowledge that multiple strokes do strike transmission line conductors, and that, if proper protection is to be maintained, devices designed to protect apparatus from the effects of lightning should not include mechanical motions which take time for restoring to normal conditions. Concerning the effect of multiple strokes upon connected apparatus, Mr. McEachron pointed out that on a line without overhead ground-wire protection only the first impulse of the series resulting from a flashover caused by a stroke some distance from the station will be transmitted along the line unaffected by the tower-footing resistance of the flashed structure; succeeding discharges in the stroke will develop potentials in the line dependent upon the *IR* drop through the tower-footing resistance. He stated also that "where overhead ground wires are used, and strokes do not contact the line conductors, the potential of the traveling wave, both for the first discharge and for succeeding ones will be dependent upon both the footing resistance and the current in the various discharges. Under these conditions, many low-current discharges which are observed upon moving film photographs of direct strokes would not be of serious consequence with reference to connected apparatus. It is at this point that the investigation is probably of greatest value, in that it indicates the number of successive discharges which had sufficient magnitude to cause operation of the protector tubes."

On the basis of an analysis of five years of operating experience with protector tubes on the transmission lines of the American Gas and Electric Company, Mr. Gross drew the following conclusions: that protector tubes, properly installed, protect line insulators against lightning flashover and appear able to operate without mechanical rupture with few exceptions; that protector tubes have reduced line outages more than 50 per cent on the average and

as much as 89 per cent in one instance; that multiple lightning strokes tend to shorten the tube life, and that in general tube life appears to depend largely on the weathering qualities of the exterior of the tube surface; that protective relays on tube-protected lines should have either a definite minimum time of not less than two or three cycles to initiate the tripping of the oil circuit breaker, or, as an alternative when using one-cycle relays, breakers should utilize ultrarapid reclosing.

Student Technical Sessions

Maintaining the District's reputation for active student participation in District meetings, were the 130-odd Enrolled Students registered. The scheduled student program of one technical session accommodating six technical papers, was enlarged to a total of 14 papers by 17 student authors, comprising a full day's schedule of two sessions, the afternoon session of which ran in parallel with the concluding technical session. The student papers presented and generously discussed were as follows:

A Cordless Telephone Switchboard, **R. P. Boyer, Jr.**, University of Maine.

Radio Direction Finders for Boats, **H. B. Abajian**, Rhode Island State College.

Simplified Solution of Differential Equations by Operational Methods, **J. T. Bradbury**, Union College.

Reignition of Short Arcs at High Pressures, **L. P. Winsor**, Harvard University.

A Radio Control for a Moving Vehicle, **D. W. Howe, Jr.**, Worcester Polytechnic Institute.

A Mechanical Analyzer for Composite Waves, **S. H. Monson** and **L. H. McHose**, Cornell University.

Stabilized Regenerative Amplifiers, **Shepard Roberts**, Massachusetts Institute of Technology.

Investigation of Heat Dissipation and Temperature Rises in Underground Ducts, **E. G. Schroeder**, Rensselaer Polytechnic Institute.

Study of Flow of Water Over Narrow Rectangular Weirs, **Cromwell McIntosh**, Union College.

Radio-Wave Polarization, **J. T. deBettencourt**, Harvard University.

Analysis of an Electron-Tube-Controlled Induction Motor, **P. P. Koliss** and **Joseph Ezen**, Worcester Polytechnic Institute.

A Kinetic Device for Determining Synchronous-Machine Characteristics, **A. H. Sullivan, Jr.**, Cornell University.

Electrical Determination of the Roots of Polynomials, **D. P. Lacock**, Massachusetts Institute of Technology.

Impulse-Voltage Investigation, **M. W. Essigmann** and **W. H. Derry**, Tufts College.

Chairman of the morning session was Lucas B. Mayer of Brown University; judges for the morning session were Professor J. D. Cobine of Harvard University, Professor R. G. Porter of Northeastern University, and Professor L. W. Hitchcock, University of New Hampshire. From among the eight papers on the morning program, these judges awarded prizes for most effective presentation as follows: first E. G. Schroeder; second, R. P. Boyer; third, D. W. Howe.

Chairman of the afternoon session was Ewan W. Fletcher of Brown University; judges were District Secretary R. G. Lorraine, Professor A. G. Conrad of Yale University, and Professor J. L. Stiles of Clarkson College. For effective presentation these judges made citations as follows: first, P. P. Koliss and Joseph Ezen; second, D. P. Lacock; third a tie between Cromwell McIntosh and A. H. Sullivan, Jr.

The large number of papers presented, and the necessity for dividing them into two session groups, caused the District committee on student activities to decide to provide duplicate awards for presentation. Subsequent critical examination of the student technical papers will lead to the final District awards which probably will be announced at the 1939 District meeting, tentatively scheduled for Springfield, Mass.

Conference on Student Activities

Under the chairmanship of Professor F. N. Tompkins of Brown University, a luncheon conference was held Friday noon, May 20, for the purpose of discussing problems incident to the conduct of student affairs in the North Eastern District. To fill the post of chairman of the District committee on student activities to be relinquished by Professor Tompkins after two years of service, Professor E. M. Strong of Cornell University was elected. Likewise, Professor A. G. Conrad of Yale University was elected to fill out the personnel of the three-man committee, Doctor E. A Walker of Tufts University continuing to serve. Lengthy discussion of the relative advantages and disadvantages of a student program of a few papers as against a student program of many papers, and of parallel versus tandem sessions, brought a decisive vote in favor of parallel sessions when warranted by the number of papers to be presented. Just what constitutes a desirable number of papers for a student session was left undecided; one school of thought favored rigorous elimination contests that would bring to the District meeting only the one best paper from each school, and the other favored more generous acceptance of a larger number of papers from each school.

Among the 36 persons interested in Student Branch activities who gathered together for the luncheon conference were the following: National Secretary H. H. Henline of New York; Director F. Ellis Johnson of Columbia, Mo., chairman of the AIEE committee on Student Branches; Vice-President A. C. Stevens of Schenectady; Vice-President-Elect C. L. Dawes of Cambridge; Past Vice-President W. H. Timbie of Cambridge; District Secretary R. G. Lorraine of Schenectady, W. W. Fletcher of Brown University Branch, and Editor G. R. Henninger of New York. Official representatives from 15 of the 16 Student Branches in the North Eastern District present were:

Student Branch Counselors and Alternates

J. D. Cobine, Harvard University, Cambridge, Mass.
E. A. Walker, Tufts College, Medford, Mass.
G. J. Fiedler, Union College, Schenectady, N. Y.
E. M. Strong, Cornell University, Ithaca, N. Y.
A. R. Powers, Clarkson College of Technology, Potsdam, N. Y.
C. D. Knight, Worcester Polytechnic Institute, Worcester, Mass.
R. O Buchanan, University of Vermont, Burlington.
C. W. Henderson, Syracuse University, Syracuse, N. Y.
L. W. Hitchcock, University of New Hampshire, Durham.
G. S. Brown, Massachusetts Institute of Technology, Cambridge.
A. G. Conrad, Yale University, New Haven, Conn.
W. B. Hall, Rhode Island State College, Kingston.
R. G. Porter, Northeastern University, Boston, Mass.
L. C. Holmes, Rensselaer Polytechnic Institute, Troy, N. Y.
F. N. Tompkins, Brown University, Providence, R. I.

Student Branch Chairman and Alternates

L. P. Winsor, Harvard University, Cambridge, Mass.
Roger Burgess, Union College, Schenectady, N. Y.
E. R. Urquhart, Cornell University, Ithaca, N. Y.
C. B. Martin, University of New Hampshire, Durham.
Samuel Carlisles, Jr., Clarkson College of Technology, Potsdam, N. Y.
D. L. Clark, University of Vermont, Burlington.
W. K. Halstead, Massachusetts Institute of Technology, Cambridge.
P. E. Feifert, Rhode Island State College, Kingston.
L. B. Mayer, Brown University, Providence, R. I.
C. R. Kolstad, Northeastern University, Boston, Mass.
E. K. Rice, Rensselaer Polytechnic Institute, Troy, N. Y.
Mortimer Rogers, Syracuse University, Syracuse, N. Y.
B. W. Greeley, Tufts College, Medford, Mass.

District Executive Committee Meets

A luncheon meeting and brief business session of the North Eastern District Executive committee was held Thursday May 19. After a discussion of routine business, unanimous vote was given to a motion to invite the Institute to hold its 1940 summer convention at Swampscott, Mass., in which event there would be no District meeting that year. (The 1939 North Eastern District meeting is scheduled to be held at Springfield, Mass.)

This meeting was attended by the following delegates:

A. C. Stevens, vice-president, AIEE
C. L. Dawes, vice-president-elect, AIEE
R. G. Lorraine, secretary, North Eastern District
F. N. Tompkins, chairman, District committee on student activities
J. L. Cantwell, secretary-treasurer, Pittsfield Section
Edward Carlson, Jr., chairman, Providence Section
W. W. Cotner, secretary, Ithaca Section
R. E. Curtis, secretary-treasurer, Springfield Section
J. A. French, chairman, Connecticut Section
H. A. McCrea, chairman, Boston Section
J. H. Rogers, delegate, Rochester Section
Victor Siegfried, chairman, Worcester Section
W. H. Lawrence, chairman, Syracuse Section

Also in attendance at the meeting were Past Chairman R. F. Chamberlain of the Ithaca Section, Director K. B. McEachron of the Pittsfield Section, and National Secretary H. H. Henline and Editor G. R. Henninger of New York.

Entertainment—Inspection Trips

The Curtis Hotel and the town of Lenox virtually opened their summer season in advance for the purpose of accommodating the 400-odd persons who attended the District meeting. Advantage of natural facilities was taken by the committee in its offering of an unusual variety of entertainment and other special features.

Most unusual feature of the entertainment program was the stag smoker held the first evening, May 18. For the purpose, the Lenox town hall was rechristened "The Gold Nugget Casino" and transported in imagination from its quiet New England setting to the scene of a Western gold mining camp of boom days. Many appropriate

costumes were noted in the crowd (minimum costume requirement for entry was the removal of necktie); the prize for the best costume of the evening went to Past Vice-President W. H. Timbie whose excellent masquerade, however, was somewhat more reminiscent of Casey Jones than of a forty-niner. A hilarious program built around a variety of games and supplemented liberally by a wide variety of refreshments, was brought to a fitting climax in a mock trial of a "cheater" supposedly caught red handed in one of the games.

A total of 185 persons attended the District's annual informal banquet that was given May 18 in the main dining room of the Curtis Hotel with Vice-President A. C. Stevens acting as toastmaster. Continuing the success of an earlier experiment, this affair was not a dinner-dance. Feature speaker of the evening was Past Vice-President W. H. Timbie who spoke at some length on the subject of the engineer's proper place in society, urging engineers to give serious attention to, and to take proper part in, all public questions. Other guest speakers who responded briefly to toastmaster Stevens' remarks were, in the order of their appearance, Director F. Ellis Johnson of Columbia, Mo., President W. H. Harrison, honor guest of the evening, and Vice-President-Elect C. L. Dawes.

During the dinner meeting District Secretary R. G. Lorraine announced the following winners of District prizes for 1937 technical papers, and made awards accordingly: (1) for the best paper, no award; (2) for the best initial paper, Bruce Prentice of the engineering general department of the General Electric Company; (3) for the best Student Branch paper, Abner Crumb, graduate of Worcester Polytechnic Institute and now with the General Electric Company.

A variety of entertainment was offered for women guests, including card parties and drives to nearby points of scenic and historic interest. Of especial interest was a double-header inspection trip through the Sawyer-Regan woolen mill and the Crane paper mill at Dalton. The trip through the woolen mill included observation of the various steps incident to the complete manufacture of high-grade woolen cloth from raw wool to the finished product; likewise tracing raw materials through the paper mill to the ultimate finished product, the inspection group had the privilege of witnessing the manufacture of the special paper which the United States Government uses for paper currency, bonds, etc.—an unusual opportunity to see the original source of a dollar bill.

Principal inspection trips for the men included transformer manufacture for one group and plastics manufacture for another, with a spectacular demonstration of the high-voltage laboratory for both groups—all at the Pittsfield works of the General Electric Company. Through the courtesy of the Stanley Club (General Electric employees club) plans were made for a student dance at the club quarters in Pittsfield following a student dinner at the Curtis Hotel in Lenox, Friday evening, May 20. Conflicting plans of individual students that called for their early return to their individual campuses for seasonal activities reduced the attendance at these two concluding functions to a low level.

AIEE Board of Directors Meets at Headquarters

THE regular meeting of the board of directors of the American Institute of Electrical Engineers was held at Institute headquarters, New York, N. Y., May 26, 1938.

Present: *President*—W. H. Harrison, N.Y., *Past-Presidents*—A.M.MacCutcheon, Cleveland, Ohio; J. B. Whitehead, Baltimore, Md. *Vice-Presidents*—O. B. Blackwell, New York, N. Y.; C. Francis Harding, Lafayette, Ind.; I. Melville Stein, Philadelphia, Pa.; A. C. Stevens, Schenectady, N. Y.; Edwin D. Wood, Louisville, Ky. *Directors*—C. R. Beardsley, F. Malcolm Farmer, and C. R. Jones, New York, N. Y.; H. B. Gear, Chicago, Ill.; F. Ellis Johnson, Columbia Mo.; W. B. Kouwenhoven, Baltimore, Md.; K. B. McEachron, Pittsfield, Mass.; C. A. Powel, East Pittsburgh, Pa. *National Treasurer*—W. I. Slichter, New York, N. Y. *National Secretary*—H. H. Henline, New York, N. Y. Present by invitation: John C. Parker, presidential nominee, New York, N. Y.

Minutes were approved of meetings of the board of directors on January 26, 1938, and the executive committee on March 29, 1938.

Actions of the executive committee on applications for election, transfer, and Student enrollment were reported and confirmed, as follows: As of April 14, 1938—475 applicants elected to the grade of Associate; as of April 22, 1938—4 applicants transferred to the grade of Fellow; 9 applicants transferred and 12 elected to the grade of Member; 48 applicants elected to the grade of Associate; 73 Students enrolled.

Reports were presented and approved of meetings of the board of examiners held April 19 and May 12, 1938. Upon the recommendation of the board of examiners, the following actions were taken: 6 applicants were transferred to the grade of Fellow; 20 applicants were transferred and 15 were elected to the grade of Member; 296 applicants were elected to the grade of Associate; 146 Students were enrolled.

Monthly disbursements were reported by the chairman of the finance committee and approved by the board, as follows: $24,797.78 in April; $24,887.08 in May.

In view of the probable effects of the present business recession on Institute membership and income, the board voted "that it is the opinion of the board of directors that every possible attempt should be made to curtail expenditures during the last quarter of the present appropriation year."

A report was presented of the special committee which was appointed, by action of the board of directors in June 1937, to make a recommendation concerning the question of adopting a permanent policy, for inclusion in the by-laws, covering the joint conferences on student activities of Districts 8, 9, and the University of British Columbia Branch, which are usually held in connection with the Pacific Coast conventions of the Institute. The committee recommended that no general rule be adopted, but that each case should be considered on its merits. The board approved the report, and, upon request of the District officers concerned, authorized such joint conference during the 1938 Pacific Coast convention, at Portland, Ore., August 9–12.

To meet changed plans in the arrangement of the summer convention sessions, the board rescinded its resolution of January 26, fixing the date of the 1938 annual meeting of the Institute as Monday, June 20, and adopted a resolution to hold the meeting on Tuesday, June 21, in Washington, D. C.

Approval was given to the dates, November 28–30, 1938, selected by the District officers concerned, for the previously authorized Southern District meeting to be held in Miami, Fla.

The following appointments of Institute representatives, made upon the recommendation of the standards committee, were reported and approved: Professors Ralph D. Bennett and Royce E. Johnson on the sectional committee for revision of the Code for Electricity Meters, *C*-12, and Messrs. J. R. North and C. F. Wagner on the sectional committee on power-line insulators.

A revision in the definition of the scope of activities of the AIEE committee on production and application of light, as recommended by the committee and amended by the technical program committee, was approved, the revised definition reading as follows:

> Treatment of those matters in which the dominant factor is the application of electrical energy through its conversion into light, including necessary materials, devices and mechanisms, in so far as these matters are considered of interest and value to the members of the Institute. This committee functions as a liaison between the Institute and various organizations dealing with the production and utilization of light, such as, the Illuminating Engineering Society, the Optical Society of America, and others. Its activities include translating the theoretical and technical accomplishments of those organizations into terms of the practical aspects of the production and applications of light, thereby serving to inform the Institute members of important progress in this field. Where problems of electric supply service, voltage, or distribution are involved, action shall be joint with the committee on power transmission and distribution.

The report of the committee on award of Institute prizes of prizes awarded for papers presented in 1937 was presented. (An announcement of the prizes awarded was published in the June 1938 issue of ELECTRICAL ENGINEERING, page 262.) The report included a recommendation that a special award be made to an outstanding committee report in the field of engineering practice which was included in the technical program, namely, a report entitled "First Report on Power System Stability," by the subcommittee on interconnection and stability factors of the committee on power transmission and distribution. The board

authorized a special award to this subcommittee report and presentation of a suitable certificate of award.

Upon recommendation of the publication committee, the board authorized that committee to make a survey of the membership, through the columns of ELECTRICAL ENGINEERING, to ascertain the number of members who would be interested in purchasing an up-to-date cumulative index of Institute papers, the latest published index covering the period 1911–1921, and to report its findings to the board of directors.

Mr. G. G. Post was reappointed a representative of the Institute on the Washington Award Commission for the two-year term beginning August 1, 1938.

The resignation of Mr. H. P. Thomas as local honorary secretary of the Institute for India, because of his plans to leave the country next fall, was accepted; and, upon his recommendation and that of the board of examiners, two local honorary secretaries for India were appointed, for the two-year term ending July 31, 1940, as follows: V. F. Critchley for Northern India and N. N. Iengar for Southern India.

The board confirmed the appointment by president of the following committee of tellers to canvass and report upon the election and constitutional amendment ballots: Frederick P. West (chairman), George F. Fowler, Henry Kurz, Edward C. Plant, T. I. Rogers, A. M. Schoettgen, and A. C. Sugden.

Professor V. Karapetoff was appointed the delegate of the Institute to the semicentennial celebration, at Columbia University, New York, N. Y., September 6–9, 1938, of the founding of the American Mathematical Society.

The following amendments to the by-laws were adopted, as the result of the board's action in January in establishing a committee on planning and co-ordination:

Present section 70 cancelled and the following substituted:

Sec. 70. The committee on planning and co-ordination shall consist of the chairmen of the constitution and by-laws, finance, publication, sections, standards, and technical program committees, the national secretary, the chairman who shall be appointed by the president from among the members of the board of directors, and such other members as the president may appoint. The committee may appoint such subcommittees, including other members of the Institute, as may be needed for specific aspects of planning.

The committee shall give continuous attention to the planning of Institute activities for the future, and submit to the Board of Directors reports and recommendations regarding any developments which, in its opinion, would more effectively meet the needs of the membership as a whole, or afford more adequate provisions for specialized types of activities deemed worthy of specific recognition by the Institute.

It shall also consider and advise on all questions arising with reference to Institute activities of all types, particularly those in which uncertainty, difference of opinion, actual conflict, or duplication may appear to exist, whether referred to it by the Board of Directors or otherwise coming to its attention.

The words "committee on planning and co-ordination" substituted for the words "committee on co-ordination of Institute activities" wherever they appear in the by-laws.

The annual report of the board of directors for the fiscal year ending April 30, 1938, as prepared by the national secretary, was submitted for approval for presentation to the membership at the annual meeting in June; and the national treasurer presented a report of Institute finances for the same period.

As required by section 37 of the constitution, consideration was given to the appointment of a national secretary for the administrative year beginning August 1, 1938; and National Secretary H. H. Henline was reappointed.

Other matters were discussed, reference to which may be found in this or future issues of ELECTRICAL ENGINEERING.

New Officers Elected at AIEE 1938 Summer Convention

AT THE annual meeting of the AIEE, held in Washington, D. C., during the Institute's recent summer convention, the report of the committee of tellers on the election of new officers to serve during the year beginning August 1, 1938, was presented. In addition to reporting the results of the election, the committee of tellers also reported the enactment of all the proposed amendments to the AIEE constitution pertaining to admission to the grade of Fellow, which were submitted to the membership for ballot earlier this year. The new amendments become effective 30 days after the annual meeting, or on July 21, 1938.

Three prominent members were honored during the convention. The election of Past-President C. C. Chesney, honorary vice-president of the General Electric Company, Pittsfield, Mass., as an Honorary Member was formally announced; only 33 men previously have been so honored. The AIEE Lamme Medal for 1937 was presented to R. E. Doherty, president of Carnegie Institute of Technology, Pittsburgh, Pa., and former chairman of the AIEE committee on education. The Gaston Planté Medal for 1937, which is the initial award of this medal, was presented by the French ambassador to G. W. Vinal, chief of the section of electrochemistry, National Bureau of Standards, Washington, D. C. A detailed report of the convention is scheduled for the August issue.

The new officers elected were as follows:

President:

J. C. Parker, vice-president, Consolidated Edison Company of New York, Inc., New York, N. Y.

Vice-Presidents:

C. L. Dawes, associate professor of electrical engineering, Harvard University, Cambridge, Mass. (North Eastern District, number 1).

F. M. Farmer, vice-president and chief engineer, Electrical Testing Laboratories, New York, N. Y. (New York City District, number 3).

A. H. Lovell, professor of electrical engineering, assistant dean of college of engineering, University of Michigan, Ann Arbor (Great Lakes District, number 5).

F. C. Bolton, vice-president and dean of the college, Agricultural and Mechanical College of Texas, College Station (South West District, number 7).

L. R. Gamble, electrical engineer, Washington Water Power Company, Spokane (North West District, number 9).

Directors:

L. R. Mapes, chief engineer, Illinois Bell Telephone Company, Chicago, Ill.

H. S. Osborne, transmission engineer, American Telephone and Telegraph Company, New York, N. Y.

D. C. Prince, chief engineer, General Electric Company, Philadelphia, Pa.

National Treasurer:

W. I. Slichter (re-elected) professor of electrical engineering, head of department, Columbia University, New York, N. Y.

The board of directors for the administrative year beginning August 1, 1938, will consist of these newly elected officers, together with the following hold-over officers: W. H. Harrison (retiring president) New York, N. Y.; A. M. MacCutcheon (junior past-president) Cleveland, Ohio; F. Ellis Johnson, Columbia, Mo.; C. R. Jones, New York, N. Y.; W. B. Kouwenhoven, Baltimore, Md.; K. B. McEachron, Pittsfield, Mass.; C. A. Powel, East Pittsburgh, Pa.; R. W. Sorensen, Pasadena, Calif.; C. R. Beardsley, Brooklyn, N. Y.; Vannevar Bush, Cambridge, Mass.; F. H. Lane, Chicago, Ill.; I. Melville Stein, Philadelphia, Pa.; E. D. Wood, Louisville, Ky.; L. N. McClellan, Denver, Colo.; J. P. Jollyman, San Francisco, Calif.; and M. J. McHenry, Toronto, Ont.

The constitutional amendments adopted will alter Section 4 of Article II, and Section 10 of Article III. These sections are quoted in the following paragraphs to show the changes made; *italic* type indicates material added by the amendments, and brackets [ ] indicate deleted material.

ARTICLE II

4. A Fellow shall be not less than 32 years of age and shall be either:

a. An electrical engineer by profession. As such he shall be qualified to design and to take responsible charge of important electrical work; he shall have been in the active practice of his profession for at least ten years, and shall have had responsible charge of important electrical work for at least three years; *and he shall have been in good standing in the grade of Member for a period of at least five years immediately preceding the date of application for Fellow grade.*

When the applicant holds, in a principal national society of an allied branch of engineering, membership of a grade for which the qualifications indicate a standing equal to that required for the grade of Fellow herein, such membership shall be considered equivalent to five of the requisite ten years of active practice of the electrical profession.

b. A professor of electrical engineering or of electrical science. As such he shall have attained special distinction as an expounder of the principles of electrical science and of electrical engineering; he shall have had at least ten years' experience as a teacher of electrical subjects, and shall have had responsible charge for three years, in an electrical course of a principal school of engineering. Any years of experience as defined in paragraph "a" that the applicant may have had as an electrical engineer shall be considered the equivalent of the same number of years of experience as "a teacher of electrical subjects." *He shall have been in good standing in the grade of Member for a period of at least five years immediately preceding the date of application for Fellow grade.*

c. A person who has done notable original work in electrical science of a character to give him a recognized standing equivalent to that required for Fellows under paragraphs "a" and "b."

d. A person regularly engaged in electrical work for at least ten years, who, by inventions or by

special proficiency in contributions to electrical science or the electrical arts or electrical literature, has attained a standing equivalent to that required for Fellows under paragraphs "a" and "b."

e. A person who holds in a principal national electrical engineering society of some other country membership of a grade for which the qualifications indicate a standing equivalent to that required for the grade of Fellow under "a" and "b."

ARTICLE III

10. *Except as otherwise provided in this Article,* application may be made for admission to any grade of membership[. Except as otherwise provided in this Article], *and* applicants shall give references to members of the Institute as follows:

For the grade of Fellow, to five Fellows.
For the grade of Member, to four Fellows or Members.
For the grade of Associate, to three Fellows, Members, or Associates.

Applications for the grade of Fellow shall result only from a proposal of five Members or Fellows, except as to applicants provided for in Article II, Section 4, Clauses c and e. Applications originating from proposals shall comply with the regulations covering admission and transfer as specified in the By-laws.

Applications may be made for transfer from the grade of [Member to the grade of Fellow, or from the grade of] Associate to the grade of Member [or to the grade of Fellow].

Should an applicant for admission or transfer [to any grade] certify that he is not personally known to the above specified number of Fellows, Members, or Associates who are sufficiently familiar with the applicant's experience to justify him in using their names as references, the Board of Examiners may accept, for the deficiency, other references, preferably professional engineers of standing.

South West Student Conference at Kansas State

The 12th annual Student Branch conference of the South West District of the AIEE, held at Kansas State College, Manhattan, May 6–7, was one of the largest ever held in the District, from the standpoint of attendance. Fourteen student Branches from the following schools were represented:

University of Arkansas, Fayetteville.
Kansas State College, Manhattan.
University of Kansas, Lawrence.
University of Missouri, Columbia.
Missouri School of Mines, Rolla.
University of New Mexico, Albuquerque.
Oklahoma Agricultural and Mechanical College, Stillwater.
University of Oklahoma, Norman.
Rice Institute, Houston, Texas.
Southern Methodist University, Dallas, Texas.
Agricultural and Mechanical College of Texas, College Station.
Texas Technological College, Lubbock.
University of Texas, Austin.
Washington University, St. Louis, Mo.

The longest distance traveled by any of the delegations to reach Manhattan was by the one from the University of New Mexico who reported the distance as around 840 miles; 98 students outside of Manhattan were in attendance, the largest number being from the University of Kansas and from Texas Technological College, each having 15 at the conference. The total attendance of students was 200, which together with 28 faculty members and counselors, made a grand total of 228. In addition, the conference was attended by L. T. Blaisdell (A'20, M'22), vice-president of the South West District, L. C. Starbird (A'32, M'35), secretary of the District, and Dean F. E. Johnson (A'13, F'31) director of AIEE.

In general the conference was considered to be one of the most successful ever held in the district; 22 technical papers were presented, and all the schools but one participated in the presentations. The papers represented a high order of technical effort and were well received by the group. The papers given were as follows:

POWER FACTOR IN UNBALANCED POLYPHASE CIRCUITS, **B. G. Philpott** and **R. F. Johnson,** University of Missouri.

DETERMINATION OF STRAY-LOAD LOSSES IN DIRECT-CURRENT MACHINES, **D. J. Evans** and **Thomas McKale,** University of Kansas.

VERTICAL DIRECTIVITY APPLIED TO BROADCAST ANTENNAS, **W. D. White,** Missouri School of Mines.

PROPELLER FANS, **Sydney Black,** Washington University.

AN IMPROVED METHOD OF OBTAINING RETARDATION DATA, **J. R. Kelling,** Agricultural and Mechanical College of Texas.

CATHODE-RAY CURVE TRACER FOR AUDIO AMPLIFIERS, **Warren L. Spielman,** Washington University.

PENTODE VACUUM TUBES AS VOLTAGE AMPLIFIERS, **Andrew Hilderbrand,** Southern Methodist University.

THE EFFECT OF CURRENT WAVE DISTORTION ON ENERGY MEAUREMENTS, **H. N. Stafford,** University of Texas.

THE NEUTRAL CURRENT SIGNALING SYSTEM, **Francis W. Ringer,** University of Oklahoma.

AN INVESTIGATION OF THE PERFORMANCE OF CIRCUIT BREAKERS TO REPLACE FUSES, **W. E. Graber** and **R. F. Horrell,** University of Kansas.

THE LOAD-BUILDING RANGE, **S. LeR. Bradley,** Oklahoma Agricultural and Mechanical College.

ELIMINATION OF AUTOMOBILE HEADLIGHT GLARE, **Lyle Donaldson,** Texas Technological College.

A CATHODE-RAY ENGINE INDICATOR, **James Roark,** University of Arkansas.

DUAL-CURRENT ELECTRIC PLANTS, **Russell E. Phillips,** Kansas State College.

DIRECTIVE ANTENNA ARRAYS, **Loyd Dorsett,** University of Oklahoma.

VARIABLE SPEED-CONSTANT TORQUE OPERATION OF INDUCTION MOTORS, **F. K. Spragins,** Rice Institute.

WAVE GUIDES AND STANDING WAVES, **W. W. Mieher** and **H. J. Zimmerman,** Washington University.

WHY "ULTRA-HIGH?" **J. Y. Bowman,** Southern Methodist University.

SERIES CAPACITORS, **Richard Poletsky,** Washington University.

AN INSTRUMENT FOR THE RESOLUTION OF VECTORS INTO SYMMETRICAL COMPONENTS, **F. D. Witt,** Rice Institute.

WIND-DRIVEN FARM ELECTRIC PLANTS, **Edward Smith** and **Vearl Huff,** Kansas State College.

HIGH-FIDELITY INSTANTANEOUS RECORDING, **R. W. Matthews,** Missouri School of Mines.

In awarding positions of merit of the papers the judges found a tie for first place between the papers by B. G. Philpott and R. F. Johnson, University of Missouri, and W. D. White, Missouri School of Mines. Second place was awarded to the paper by H. N. Stafford, University of Texas. The winners will receive conference certificates as prizes of merit.

At the banquet held on Friday evening Doctor F. D. Farrell, of Kansas State, extended greetings and a hearty welcome to the visitors. Short talks were given by Dean Johnson of the University of Missouri, and by L. C. Starbird. The address of the evening was given by L. T. Blaisdell, in which he voiced the importance of membership in professional technical societies because of its value to the individual and the engineering profession.

After the banquet the students adjourned to the college dance hall where "dates" had been provided for the visitors; 100 couples attended the dance.

Following the technical session on Saturday, a luncheon and business meeting was held for the counselors at which Professor N. F. Rode, of Texas Agricultural and Mechanical College was elected chairman of the counselors for the coming year, succeeding Professor Chester Russell, Jr., of the University of New Mexico. A luncheon and round-table discussion also were held for the student chairmen.

Transformer Subcommittee Discusses Standards

At a meeting of the transformer subcommittee of the AIEE committee on electrical machinery held May 20, 1938, at Lenox, Mass., during the recent AIEE North Eastern District meeting, the proposed American Standard on transformers, regulators, and related matters was discussed. I. W. Gross, chairman of the subcommittee has made available the following report of actions taken.

The following outstanding objections were raised to the proposed Standard in its present form:

1. The Standard should be issued separately, and the appendix, test code, and recommendations for operation also should be a separate publication.
2. In its present form the proposed Standard is entirely too voluminous and contains a large amount of material not required in this type of Standard.
3. The standardization of transformer sizes, taps, etc., does not properly belong in a Standard of this type.
4. The text of the manual should be free from any mandatory requirements for operation of equipment; and if suggestions and operating procedure are made at all, they should not be in the Standard but rather in the second publication (test code, etc.).
5. There is entirely too much duplication in the present setup, and this should be eliminated.

A sub-subcommittee of four members was appointed to go over the proposed transformer standard and report back at the next meeting of the subcommittee. In the meantime, it is understood that no action will be taken to put the proposed standard into force.

The subject of front-of-wave test was discussed and progress reported, although definite decision was not reached as to desirable rates of voltage rise, methods of measurement, and definite specification in accordance with voltage classes of equipment.

The subject of impulse testing with 60-cycle excitation on the transformer also was discussed, and some difference of opinion was expressed as to the necessity of having the transformer excited when being impulse-tested. The majority favored retaining the test, although it was pointed out that some complications in commercial testing could be avoided if the 60-cycle excitation were omitted. It was not definitely shown from the discussion that 60-cycle excitation on equipment under impulse test is a definite means of locating equipment failures if such occur. The matter will be discussed further at a subsequent meeting of the subcommittee.

Report of the Board of Directors

THE board of directors of the American Institute of Electrical Engineers presents herewith to the membership its 54th annual report, for the fiscal year ending April 30, 1938. A general balance sheet showing the condition of the Institute's finances on April 30, 1938, together with other detailed financial statements, is included herein. This report contains a brief summary of the principal activities of the Institute during the year, more detailed information having been published from month to month in ELECTRICAL ENGINEERING.

BOARD OF DIRECTORS' MEETINGS

During the year, the board of directors held five meetings, four in New York City, and one at Milwaukee, Wis. The executive committee meetings in December and March were held in place of regular meetings of the board. Information regarding many of the more important activities of the Institute which have been under consideration by the board of directors and the committees is published each month in the section of ELECTRICAL ENGINEERING devoted to "News of Institute and Related Activities."

PRESIDENT'S VISITS

President Harrison attended the Pacific Coast and winter conventions and the Middle Eastern District meeting. He also visited many Sections and some Student Branches. During May and June, President Harrison will attend the North Eastern District meeting in Lenox, Mass., and the summer convention in Washington, D. C., and make a few other visits.

The places visited are listed below:

California
- Los Angeles Section
- San Francisco Section

Colorado
- Denver Section

Illinois
- Urbana (District conference on student activities)

Indiana
- Central Indiana Section, Lafayette
- Fort Wayne Section
- Purdue University, Lafayette

Iowa
- Iowa Section, Des Moines

Louisiana
- New Orleans Section

Michigan
- Detroit-Ann Arbor Section, Detroit

Minnesota
- Minnesota Section, Minneapolis

Missouri
- Kansas City Section
- St. Louis Section

Nebraska
- Nebraska Section, Omaha

New York
- New York Section
- Winter Convention
- Pratt Institute, Brooklyn

North Carolina
- North Carolina Section, Chapel Hill

Ohio
- Akron Section
- Cincinnati Section
- Columbus Section
- Ohio State University, Columbus

Oklahoma
- Oklahoma City Section

Pennsylvania
- Lehigh Valley Section, Wilkes-Barre
- Philadelphia Section
- Pittsburgh Section

Tennessee
- Memphis Section

Texas
- Dallas Section
- Houston Section

Washington
- Spokane (Pacific Coast Convention)

Wisconsin
- Milwaukee (Summer Convention)

Canada
- Toronto Section

NATIONAL CONVENTIONS

Three national conventions were held during the year, and a brief report on each follows:

Summer Convention. The 53d summer convention was held in Milwaukee, Wis., June 21–25, 1937. During 10 technical sessions, 35 technical papers, 5 committee reports, and 3 addresses were presented. Two technical conferences were held: one on field problems, and the other on electrical apparatus for three-phase arc furnaces. Convention events of unusual interest were a lecture by Doctor Vannevar Bush on Tuesday evening, an address by Doctor R. E. Flanders during the first part of the general session on Wednesday morning, and the subsequent introductory discussions by six members on various phases of Institute programs, which were followed by general discussion.

Other parts of the convention were the annual business meeting, conference of officers, delegates, and members, president's reception, followed by dinner and dancing, boat trip on Lake Michigan, buffet supper and smoker, golf and tennis tournaments, ladies' events, and farewell gathering. The registration was 1,067.

Annual Meeting. The annual business meeting of the Institute was held on Monday morning, June 21, as part of the opening session of the summer convention. The annual report of the board of directors for the fiscal year which ended April 30, 1937, was presented in abstract by the national secretary. A report on the finances of the Institute was presented by National Treasurer W. I. Slichter. The report of the committee of tellers upon the election of officers for the year beginning August 1, 1937, was presented, and President-Elect Harrison responded to his introduction with a brief address.

Pacific Coast Convention. The 25th Pacific Coast convention was held in Spokane, Washington, August 31 to September 3, 1937, with a registration of 266. Six technical sessions, two student sessions, a joint conference on student activities, reception and dancing, a banquet, inspection trips, a golf tournament, and ladies' events constituted the principal features of the convention. One of the technical sessions was held jointly with the Institute of Radio Engineers.

Winter Convention. The 26th winter convention was held in New York City, January 24–28, 1938, with a technical program including 66 papers in 16 sessions, 4 technical conferences, and 3 addresses. During a general session on Wednesday morning, brief addresses were given by President Harrison, and T. F. Barton, chairman of the winter convention committee, the Alfred Noble Prize was presented to Doctor G. M. L. Sommerman, and Doctor H. G. Moulton, president of the Brookings Institution, gave an address on "Technological Development in Relation to Economics."

At an evening session, the Edison Medal was presented to Past President Gano Dunn; and Stephen F. Voorhees, senior partner of Voorhees, Gmelin and Walker, gave an illustrated lecture on the "New York World's Fair, 1939."

A smoker, numerous inspection trips, and ladies' events completed the program of the convention which had a registration of 1,438.

DISTRICT MEETINGS

Brief reports on the two District meetings held during the year are given below.

North Eastern District Meeting. This meeting was held in Buffalo, N. Y., May 5–7, 1937, with five sessions, including one for student papers, a dinner and a second evening meeting, each with a talk and demonstration, a District conference on student activities, inspection trips, and ladies' events. The registration was 352.

Middle Eastern District Meeting. The meeting of this District was held in Akron, Ohio, October 13–15, 1937, with seven technical sessions, including one for the presentation of student papers, a banquet, dinner and entertainment at Nela Park, inspection trips, conference on student activities, and ladies' events. The registration was 464.

SECTIONS

The Sections maintained unusually keen interest in their activities during the past year. The total number of meetings reported was slightly larger than the number for 1936–37, which far exceeded that for any previous year. Interest in technical groups and other forms of more specialized meetings continued strong, and special efforts were made in some Sections to determine the particular interests of their membership with reference to subjects.

As usual, a considerable number of Sections offered prizes for the best papers presented in competition, and the interest in encouraging student participation in Section programs produced several excellent joint meetings with Branches.

Three new Sections were organized during the year: Wichita in September, Tulsa in October, and Muscle Shoals in February, and each took its place among the more active Sections. These brought the total number to 65.

The name of the Atlanta Section was changed to Georgia Section, and its territory was extended to include the entire state.

Table I. Section and Branch Statistics

	For Fiscal Year Ending			
	April 30, 1932	April 30, 1934	April 30, 1936	April 30, 1938
Sections				
Number of Sections	60	61	61	65
Number of Section meetings held	497	472	540	624
Total attendance	105,325	73,271	85,501	110,148
Branches				
Number of Branches	109	113	118	120
Number of Branch meetings held	1,135	1,015	1,045	1,334
Total attendance	54,197	41,772	45,304	60,446

The Sections committee completed a year's study of the various Section activities in an endeavor to facilitate co-operation between Sections, and to enable the Sections to serve their communities more effectively. Self-analysis blanks were filled out by the Sections, and the results were studied by a subcommittee. The findings of this study were published in the March issue of ELECTRICAL ENGINEERING, pages 134–5.

The Sections committee also made a compilation of the various plans which the different Sections are using in dealing with the local membership problems. A detailed outline was prepared of the more successful plans, and a copy was sent to each Section. The object of this study was to aid the Sections in settling satisfactorily their individual problems concerning local membership.

More detailed information on these activities may be found in the annual report on Section and Branch activities in the June issue of ELECTRICAL ENGINEERING, pages 263–3.

STUDENT ACTIVITIES

A new Branch organized at Northwestern University brought the total number to 120. A large majority of the Branches carried on a substantial amount of activity, but two reported no meetings. The total number of meetings reported was below that for the preceding fiscal year, but larger than the total for any previous fiscal year.

The extensive participation by students in the technical programs of national conventions and District meetings was continued, student sessions having been held as follows: North Eastern District meeting in Buffalo, one, Pacific Coast convention in Spokane, two, and Middle Eastern District meeting in Akron, one.

With the endorsement of the chairman of the committee on Student Branches, the committee on safety sent a letter of October 30, 1937, to the counselors of all Student Branches suggesting that each Branch have presented "a paper dealing with some phase of the problem of the prevention of accidents or remedial measures after an electrical shock." Twenty-four Branches followed this suggestion.

The terms of enrollment of 1,474 Students expired on April 30, 1938, and 703, or about 48 per cent, applied for admission as Associates.

SECTION AND BRANCH STATISTICS

Data on the Sections and Branches are given in table I.

TECHNICAL PROGRAM COMMITTEE

The general review and study of the planning, scope, and procedures of the programs of Institute meetings, which had been carried out during the previous year, resulted in two changes which have been put into effect in the course of the current year and which are believed to be important forward steps.

Advance Copies of Technical Papers. A subcommittee of the technical program committee, under the chairmanship of R. N. Conwell, as a result of their study, recommended last July that "the Institute adopt as a policy the provision of preprints of technical articles submitted as program material." This proposal had been made by the publication committee, and was discussed and approved at the conference of officers, delegates, and members held at the summer convention in Milwaukee. The recommendation was approved by the new technical program committee appointed the first of August, by the publication committee, and, in October 1937, by the board of directors. As a corollary to this recommendation, ELECTRICAL ENGINEERING is relieved of the necessity of publishing all technical papers, but will include about two-thirds of them. The TRANSACTIONS will in the future include all of the formal technical program papers rather than consisting of a reprinting of ELECTRICAL ENGINEERING as in recent years.

The change to the new procedure has been carried out gradually during the year, and the summer convention in Washington will be the first meeting at which the new policy is completely effective. At the winter convention in January, advance copies were provided for 39 out of 65 papers, the others having previously been published in ELECTRICAL ENGINEERING. The advance copies are sold at a nominal price (in addition to a limited free distribution). The response of the membership has been good, and it is anticipated that the average distribution of 212 copies of the advance copies of winter convention papers (not including quantity orders, averaging 40 copies per paper) will be increased as the plan becomes fully effective and as the membership becomes accustomed to it.

General Meetings. The "special committee on Institute activities" arranged for a meeting of broad general interest at the summer convention in Milwaukee, to which a half day was devoted without parallel sessions. At this meeting, Doctor Ralph Flanders addressed the Institute on the subject "The Engineer in A Changing World." This was followed by a discussion by members of the Institute on the subject "How Can Institute Programs Be Made of Greatest Value to the Membership?" This discussion evoked so much interest that it was continued in the afternoon of the following day.

Based upon this experience, the special committee on Institute activities recommended to the board of directors that while "major emphasis should continue to be given to the technical programs substantially along the present lines," the programs of Institute meetings should frequently include "sessions at which subjects of general interest to all the members are discussed." This recommendation was approved by the board in August 1937, and the technical program committee has been guided by it in the programs for the current year.

At the winter convention Doctor Harold G. Moulton, president of the Brookings Institution, Washington, presented an address on "Technological Development in Relation to Economics." His penetrating analysis of this subject proved of great interest to the membership. At the approaching summer convention in Washington, arrangements have been made for a general session to which Wednesday morning will be devoted, at which the Institute will be addressed by Doctor W. R. Gregg, chief of the Weather Bureau, and Colonel J. M. Johnson, assistant secretary of the Department of Commerce on aeronautics. Also, at the business meeting on Tuesday morning, it is hoped that an address will be given on municipal planning in Washington, by an appropriate official.

Technical Programs. Certain information regarding the technical programs for the national conventions and District meetings for the current year in comparison with the previous year is given in table II.

These figures show a marked increase in the Institute's activity. The increase in registration at national conventions and District meetings is especially striking. There was one more convention this year than last (the Pacific Coast convention and summer convention having been combined in 1936), but, even after allowances for that fact, the registration has increased by 20 per cent.

Attention is called to the material decrease in the average length of paper which is, the committee believes, a worth-while achievement. Engineering papers tend to be too long for maximum effectiveness, and in many cases the approval of a paper is delayed by the process of having it shortened. It is hoped that authors will co-operate with the technical committees and the technical program committee in continuing this trend toward shorter papers.

Table II. Technical Programs, Last Two Years

	April 30, 1937 to April 30, 1938	April 30, 1936 to April 30, 1937
Number of sessions	43	37
Number of conferences	8	10
Number of papers presented	155	124
Registration at national conventions and District meetings	3,590	2,720
Average length of paper, pages	6½	7½

In comparison with a budget of 1,115 pages for the previous appropriation year, the technical program committee is operating this year on a budget of 1,200 pages of papers recommended for the TRANSACTIONS plus provision for duplicating in small quantities 300 pages of additional material for presentation only. Because of the change in the publication procedure associated with the provision of advance copies for technical meetings, a considerable part of the expense of publishing this year's technical papers will go over into next year's budget. In the approval of papers, however, the technical program committee has laid its plans on the basis of adhering to the allotted budget, since the carry-over of publication expense will, of course, affect next year's budget.

The satisfactory results of the year's work and the real progress which has been made have come about through the loyal co-operation and devoted efforts of the chairmen of the technical committees, the members of the technical program committee, and of other committees co-operating with them, and the untiring zeal of Mr. Rich and other members of the staff involved in the work of the committee.

PUBLICATION COMMITTEE

During the year, there has been put into effect the revised publication policy approved by the board of directors at its October 28, 1937, meeting, and described on page 1409 of the November 1937 issue of ELECTRICAL ENGINEERING. This revised policy has made it possible not only to meet more fully the diversified interests of the membership with reference to ELECTRICAL ENGINEERING and TRANSACTIONS, but also to make available in advance photolithographic copies of manuscripts of technical program papers, and to shorten the time required to make technical program papers available for distribution; all of this, of course, within the limitation of the publication budget. Also a real improvement has been made in the efficiency of operation of the publication office.

At the 1938 winter convention, over 3,600 separate advance copies of technical program papers were sold, and practically all of the comments received with reference to the arrangement as a whole and with reference to the form of the advance copies have been favorable.

One feature of the revised publication policy is that discussions are correlated with their respective papers, both in the TRANSACTIONS section of ELECTRICAL ENGINEERING and in the bound annual volume of TRANSACTIONS. While the new policy was made effective, in general, with the January 1938 issue of ELECTRICAL ENGINEERING, the full effect of the new policy will not be evident until the issuance of the September 1938 number. The change from prepublication of technical program papers in ELECTRICAL ENGINEERING to postpublication naturally could not be made completely in any one issue. Beginning with the April 1938 issue, the discussions are correlated with all the technical program papers published. However, until the September issue, there will appear separate discussions pertaining to technical program papers which were published before the discussions became available.

Table III. Membership Statistics for the Fiscal Year Ending April 30, 1938

	Honorary	Fellow	Member	Six-Year Associate	Associate	Total
Membership on April 30, 1937	10	709	4,118	5,791	4,680	15,308
Additions						
Transferred	1	25	151	614		
New members qualified		1	167	39	1,428	
Former members reinstated		2	14	27	19	
	11	737	4,450	6,471	6,127	17,796
Deductions						
Died	2	16	34	29	11	
Resigned		4	37	153	120	
Transferred		1	17	149	624	
Dropped		6	46	185	284	
Membership on April 30, 1938	9	710	4,316	5,955	5,088	16,078

The improved efficiency in the publication office is permitting more attention to be given to the publishing of a suitable proportion of general interest articles in ELECTRICAL ENGINEERING. This is a continuation of the policy outlined in last year's report.

Early in the year there was brought to a satisfactory conclusion the publication of the "Lightning Reference Book." The attempt to handle this matter on a self-supporting basis was entirely successful, and the form and appearance of this volume have received very favorable comment. As a result of the success of this venture, consideration is being given to the publication of other books on a similar self-supporting basis.

In recognition of the duties and responsibilities he has been carrying regularly for a number of years, F. A. Norris was appointed business manager of ELECTRICAL ENGINEERING, effective November 15, 1937. This involved no change in the salary account of the publication office.

MEMBERSHIP COMMITTEE

The membership committee has continued its activity along lines similar to those of the last few years. An active national committee of 21 members and Section committees or representatives in all of the Sections have continued their work throughout the entire year. Two meetings of the national committee were held in New York, one being at the time of the winter convention to permit a large percentage of the committee to be present.

Continuing the policy of last year in passing along increased responsibility to the District vice-chairmen of the committee, it was recommended, and the board of directors approved the proposal, that the vice-chairmen become members of their respective District executive committees. The vice-chairmen, supported by their respective Section membership committeemen, have worked in close contact with each other to produce a good record for the year.

The general business conditions now affecting a large portion of the industrial areas in the country have had their effects upon the membership returns, as will be noted in table IV wherein it is seen that the total number of applications received is slightly smaller than last year. The hard work of the Section committees has done much to prevent a smaller figure appearing in this column. It is interesting to note in the same table that the applications received from students has, however, slightly increased over last year, in spite of the current economic conditions. The strong efforts made by the committees to induce Enrolled Students whose terms were expiring to apply for admission as Associates has been largely responsible for this figure not falling below last year's report. Though the total number of applications received is less than last year, it must be said, in all fairness, that seven of the ten Districts returned more applications than they did for the year 1936–37.

In spite of the decrease in the number of applications received, the total membership of the Institute has been increased by 770 members. This makes the total membership 16,078, as compared with 15,308 one year ago. This compares with the 708 increase for last year. The number of members dropped during the year, due to failure to meet Institute requirements, was 521, as compared with 526 last year.

Table V shows an interesting increase in the number of Enrolled Students. These men form a very important source of new members for the Institute each year.

Table IV. Number of Applications Received From Enrolled Students and From All Others

Year Ending	From Students	From All Others	Total
April 30, 1938	739	932	1,671
April 30, 1937	716	1,040	1,756
April 30, 1936	631	946	1,577
April 30, 1935	575	715	1,290
April 30, 1934	467	496	963

Table V. Number of Enrolled Students

April 30, 1938	5,037	(2,428)
April 30, 1937	4,503	(2,249)
April 30, 1936	4,049	(1,991)
April 30, 1935	3,806	(1,983)
April 30, 1934	3,186	(1,548)

Following the number of Students reported for April 30 of each year is indicated within parentheses the number of new applications received during that year; the difference between this number and the reported total, of course reflects the number of renewals of Student enrollment for the corresponding period.

Table VI. Number of Members in Section Territory Reinstated

August 1, 1937 to April 30, 1938	306
Year beginning August 1, 1936	503
Year beginning August 1, 1935	663
Year beginning August 1, 1934	831
Year beginning August 1, 1933	741

Table VI indicates a decrease in the number of former members who have been reinstated in Section territory. The number of delinquent members available for reinstatement has been decreasing continuously, which, of course, accounts for the smaller number reinstated each year, but it is also probable that present economic conditions have had their effects in further decreasing the number this year. It will be noted that the figure 306 applies to a nine-month period. The figure for the same months last year was 460.

It is encouraging to note that the record of members who have their dues fully paid as of April 30th has again increased slightly in spite of the conditions now existing. This is shown in table VIII.

Although the Institute's membership is still somewhat less than the peak reached in 1927—see table IX—it has been continually increasing since the low figure of 1935 reached as an effect of the business depression.

Deaths

The following deaths occurred during the year:

Honorary Members: Guglielmo Marconi, Ambrose Swasey.

Fellows: Philip P. Barton, Byron B. Brackett, Kay A. Christiansen, Clarence L. Cory, Maurice Costa, David F. Crawford, Henry W. Fisher, George E. Hayler, Samuel E. M. Henderson, John W. Howell, Arthur L. Mudge, Peter W. Sothman, Edwin R. Stoekle, Charles W. Stone, Joseph A. Thaler, Norman T. Wilcox.

Members: Harry A. Baker, Clifford W. Bates, Norman M. Baxter, Bennett M. Brigman, Charles Brossman, Frank D. Burr, E. R. Carichoff, Walter Cary, E. S. Code, James A. Correll, H. Milton Dearmin, Edgar D. Edmonston, William B. Folline, Edwin P. Harder, H. Lester Harris, Joseph A. Hepp, William M. Joy, Albert B. Junkins, Emil M. Kaegi, Charles Max, William F. McLaren, Theodore B. Morgan, Edward L. Nichols, Edward J. Pratt, Frank B. Rae, Charles P. Randolph, Ralph T. Rossi, Howard T. Sands, Carl G. Schluederberg, James F. Schnabel, Carroll Shipman, Arthur Townsend, Henry H. Vrooman, Henry H. Wait.

Associates: David C. Bacon, Maurice Barrere, Max A. Berg, Robert C. Brown, Francis E. Cabot, Charles L. Cadle, Paul A. Callis, Robert A. Connor, L. W. Copeland, Harry G. Cotter, Frank L. Dalas, Alfred W. Dater, Lucius F. Deming, Robert J. Deneen, E. A. Enquist, Milton M. Gess, Joseph Goodman, Russell S. Gueffroy, William G. Heptinstall, Edward W. Judy, Emil E. Keller, Thomas H. Kettig, Robert King, Hugh Lesley, Mrs. Zella A. McBerty, George E. McLean, Winfred Morrill, Albert J. J. Murphy, William M. O'Brien, Joseph H. Paget, John Pearson, Benjamin Robinson, William G. Rogers, Michael Romano, Banka A. Roy, Henry W. Taylor, Robert Taylor, Wilbur S. Werner, Philip B. Woodworth, George R. Wright.

Committee on Transfers

The committee on transfers gave intensive consideration to the development of desirable methods of encouraging members who are qualified for the higher grades to submit applications for transfer.

The following paragraphs were prepared by the committee for inclusion (with modifications to conform to any amendments to constitution and by-laws that may be adopted) in the general letter sent to Section officers in September of each year by the national secretary:

"The officers of each Section should consider the matter of encouraging members of the Institute who are fully qualified for the higher grades to submit their applications for transfer, and should set up in their Section means for such encouragement. The means should be appropriate to the situation in the Section. A Section committee on transfers consisting of three or five older men (Fellows and Members), who know the Section membership well, is probably the best. Such a committee continuing on from year to year will come to know the situation and can act with discretion. The Section membership committee can no doubt be of considerable help in this work, especially in encouraging Associate to Member transfers.

"The regulations covering transfer will be found in the constitution, sections 10–14, 16, and by-laws, sections 2–4, 7–9, 13.

"Any questions which any group has should be referred to H. E. Farrer, secretary, board of examiners, AIEE, 33 West 39th Street, New York, N. Y."

Table X contains the numbers of applications for transfer to the grades of Fellow and Member recommended and not recommended by the board of examiners during the past 12 years.

Board of Examiners

The board of examiners held 11 meetings during the past year, averaging about two and one half hours each, and considered 3,956 cases, divided as shown in table XI.

Standards Committee

The report of the standards committee of a year ago reflected a considerably increased activity in the standardization field. That general high level has continued throughout the year just ended. Several Institute committees have been carrying on much preliminary development work later to be submitted to American Standards Association as the basis of American standards. Likewise, the sectional committees working under ASA procedure have brought to completion many projects that now have the full status of American standards.

At this point, it might be advisable to call attention to an action taken at the October 1937 meeting of the standards committee. A recommendation was made to the directors at that meeting, and later approved by them, suggesting the carrying out by the Institute's technical committees of a survey of the entire electrical standardization field. Such a survey, it was felt, would be the most effective way of determining what fundamental standardization should be under way and how the Institute could most effectively continue to play its rightful part in such work. Concrete indications of the results of the recommendation made are now becoming apparent, although no evidence of fundamental standardization overlooked has been uncovered in any survey reported to date.

A statement of actual detailed actions taken by the standards committee during the year will not be attempted here, as those actions are all matters of record. In general, it has been necessary to make many new committee appointments, because the work of many sectional committees has reached a stage calling for reorganization, and others long inactive have become active. Certain changes in sponsorship of sectional committees also have taken place.

During the year, two Institute standards, "Relays" and "Automatic Stations," received in revised form the approval of ASA as American standards. Likewise, it was deemed desirable for the Institute to give official approval to the publication of a revision of its existing standard for "Oil Circuit Breakers." This action was taken in order to place immediately in the hands of industry many new data on breakers developed by the committee on protective devices. The revised standard, it is understood, will eventually become part of the American standard for "Oil Circuit Breakers" now in course of development by the sectional committee on power switchgear.

The standards committee put into operation a recommendation received from the committee on co-ordination of institute

Table VII. Membership of the Institute, April 30, 1938

Of the 16,078 members reported for April 30, 1938, 14,127 are fully paid to April 30, 1938. The balance of 1,951 are divided into the following groups:

1. Members owing dues to April 30, 1937.
Total number of members who have not acted upon resolution of board of directors adopted in January 1938 providing an extension of time for payment of these dues 470

2. Members owing dues to April 30, 1938 1,481

(During the period May 1 to 17, 1938, 270 members have paid dues to April 30, 1938, reducing the total to 1,211.)

Table VIII. Memberships Fully Paid

	Membership as of April 30	Number of Members Fully Paid as of April 30	Per Cent Fully Paid
1938	16,078	14,127	87.9
1937	15,308	13,439	87.8
1936	14,600	12,446	85.2
1935	14,269	11,512	80.5
1927 (year of maximum membership)	18,344	16,247	88.5

activities calling for the organization of a subcommittee to consider the electrical characteristics of bushings. As it is planned to make the personnel of this committee inclusive of all interested groups, it is felt their report will eventually be generally acceptable.

At the February meeting, one subject was discussed, which may prove of great interest to the entire electrical industry. It was suggested that consideration be given to a possible revision of many of the established ideas on the rating of all types of electrical machinery. There would be involved such questions as temperature endurance limits of insulating materials, the classification of new materials, methods of temperature measurement, and rating versus performance under operating conditions. As the first step in the proper approach to these questions, it was agreed that if possible a symposium should be arranged at an Institute convention calling for a thorough discussion of the points outlined, together with the presentation of related data. Arrangements for a symposium are now under way.

United States National Committee of the IEC

Although no plenary meeting of the International Electrotechnical Commission was held during the past year, meetings of seven advisory committees were held. These covered: section *B* on transformers of advisory committee No. 2 on rating of electrical machinery; No. 8 on standard voltages and currents and high voltage insulators, with special relation to impulse voltages; No. 9 on electric traction equipment; No. 13 on electrical measuring instruments; No. 22 on electronic devices; No. 12 on radio-communications; and No. 7 on aluminum. In addition, a meeting of the committee of action of the IEC was held, at which a number of important decisions with respect to the work of the IEC were taken.

It will be recalled that last year it was reported that consideration was being given to international standardization on acoustics. After full discussion in the committee of action, the IEC decided to recommend that the International Standards Association (ISA) be invited to undertake the general organization of the standardization work in the field of acoustics, the IEC being ready to co-operate with the ISA through an advisory committee on electroacoustics. This recommendation was accepted by the ISA, and a meeting was held in Paris in June 1937 at which a number of important decisions were taken. The most important of these had to do with the acceptance of the American reference level for sound measurements of 10^{-16} watts per square centimeter, thus making this effectively a world standard.

The committee of action also undertook a study of the most effective manner of handling within the IEC standardization work on co-ordination of insulation. The various advisory committees concerned have been contacted and the opinion of the various national committees sought. A decision in the matter will be taken shortly.

New IEC projects on electric welding—No. 26—and electroheating—No. 27—have been initiated recently.

New Publications. New publications issued during the past year include a new IEC specification for a-c circuit breakers (Publication No. 56) which covers definitions, rules for rating, and rules for type tests for a-c circuit breakers; an appendix to IEC Publication No. 46 on steam turbines covering supplementary notes to section 4 of instruments and methods of measurement of the rules for acceptance tests. Also a draft of a revised edition of Publication No. 38 on standard voltages was issued.

International Vocabulary—No. 1. The International Electrotechnical Vocabulary, which it was expected would be available during the past year, entailed so much work that it was not possible to have the first edition ready for distribution. It is now hoped, however, that it will be available before the end of the current year.

Radio Interference. Several meetings of the international special committee on radio interference were held, and a considerable volume of work done concerning the methods of measuring radio noise which are used in the different countries. This work has resulted in the development of a standard measuring apparatus which is being manufactured in Belgium and sold to the various countries interested. Consideration is being given in this country to securing this apparatus for test in this country. After the results obtained by the use of this apparatus are available to the international special committee, discussions of the results on a comparable basis will be possible.

Plenary Meeting. A plenary meeting of the IEC is now scheduled to be held in Torquay and London, England, June 22 to July 1. At this time meetings of 21 advisory committees, as well as of the international committee mixed on traction, the committee of action and the council of the IEC will be held. As would be expected, much of the work of the advisory committees during the past year has been devoted to preparations for this complete series of meetings. The United States national committee will be well represented, its total delegation probably numbering about 22 individuals, including the president and secretary of the USNC. In addition, James Burke, the president of the IEC, who is an American, will be in attendance.

Committee on Safety

In line with the change in the by-laws of the Institute, the committee on safety has, with an enlarged program, replaced the committee on safety codes which had been in existence for a number of years, and had rendered valuable service to the Institute. It was felt that the time had come to enlarge the functions of this committee and hence the change in the by-laws and organization were approved.

The committee held three meetings during the year, and has instituted a program based primarily on education. Through co-operation with the appropriate committees of the Institute, letters were forwarded to the counselors of Student Branches and to the chairmen of Sections, recommending that during the year at least one meeting should be devoted to the reception and discussion of a paper dealing with some phase of safety or remedial measures after electrical shock. As a result of these letters, a considerable number of Student Branches and Sections have had papers presented to them and interesting discussions of these papers have taken place. In the case of other Sections and Student Branches, their programs for

Table IX. Record of AIEE Membership

Year	Total Membership May 1	Year	Total Membership May 1	Year	Total Membership May 1
1884	71	1903	2,229	1921	13,215
1885	209	1904	3,027	1922	14,263
1886	250	1905	3,460	1923	15,298
1887	314	1906	3,870	1924	16,455
1889	333	1907	4,521	1925	17,319
1890	427	1908	5,674	1926	18,158
1891	541	1909	6,400	1927	18,344
1892	615	1910	6,681	1928	18,265
1893	673	1911	7,117	1929	18,133
1894	800	1912	7,459	1930	18,003
1895	944	1913	7,654	1931	18,334
1896	1,035	1914	7,876	1932	17,550
1897	1,073	1915	8,054	1933	17,019
1898	1,098	1916	8,202	1934	15,200
1899	1,133	1917	8,710	1935	14,269
1900	1,183	1918	9,282	1936	14,600
1901	1,260	1919	10,352	1937	15,308
1902	1,549	1920	11,345	1938	16,078

Table X. Applications for Transfer During the Past 12 Years

Year Ending April 30	Fellow Grade Recommended	Fellow Grade Not Recommended	Fellow Grade Total	Member Grade Recommended	Member Grade Not Recommended	Member Grade Total
1927	30	5	35	293	32	325
1928	21	3	24	280	17	297
1929	45	2	47	229	19	248
1930	28	2	30	211	29	240
1931	44	3	47	322	31	353
1932	7	2	9	149	17	166
1933	29	2	31	109	11	120
1934	25	2	27	154	3	157
1935	19	2	21	199	23	222
1936	27	1	28	205	24	229
1937	24	2	26	167	27	194
1938	26	0	26	137	7	144
Totals	325	26	351	2,455	240	2,695

Table XI. Applications for Admission and Transfer

Applications for Admission		
Recommended for grade of Associate	964	
Re-elected to the grade of Associate	119	
Not recommended	16	1,099
Recommended for grade of Member	140	
Re-elected to the grade of Member	28	
Not recommended	34	202
Recommended for grade of Fellow	1	
Re-elected to the grade of Fellow	—	
Not recommended	1	2
Applications for Transfer		
Recommended for grade of Member	159	
Not recommended	11	170
Recommended for grade of Fellow	31	
Not recommended	—	31
Students		
Recommended for enrollment as Students		2,452
Total		3,956

the year were completed when the committee's letter was received, but arrangements have been made that the matter will receive consideration during next year. From the letters received from the Sections which had these papers presented to them, it is quite apparent that there is a very active interest in this subject among the members and among the students.

Letters to professors of electrical engineering in some 120 universities and colleges were sent out, recommending that at least the senior students receive instruction and training in artificial respiration, as they would be required to have this knowledge on entering industry. As a result of these letters, active training of senior students has been either increased or instituted in more than half of these colleges. As a result of the answers to these letters, it was found that, in some colleges and universities, courses in accident prevention are carried out, in some instances on a voluntary basis, but in other instances being required for the degree. The committee is very appreciative of the general co-operation given by the professors of electrical engineering.

Arrangements are on foot to have presented to the Institute papers on specific subjects dealing with the prevention of accidents. One paper that has been generally requested is at present in preparation.

Representatives of the committee have attended meetings of the National Fire Waste Council, the National Fire Protection Association, and a meeting of representatives of safety committees in engineering associations called by the engineering section of the National Safety Council.

In laying down a basic principle, the committee feels that a design to be efficient must be safe to construct, operate, and maintain, and that electrical engineers not only deal with material things, but also are in many cases responsible for the organization, training, and direction of men in the construction, installation, and operation of plant and equipment. For this reason, they are vitally interested in the protection of these men from accident.

Every endeavor has been made in carrying out the work of the committee to keep it practical and on a sound foundation upon which more extensive programs can, in the future, be built.

Co-ordination Committee

In addition to its duties concerned with the national and District meetings referred to it by the board of directors, the committee has given serious attention, at the request of the president, to the problem of long range planning for the Institute as a whole. It has recommended to the board a reconstitution of the committee, to be called the committee on planning and co-ordination, and alterations in the by-laws which would assign to this new committee the task of long range planning studies, with particular reference to the interests of special groups within the Institute membership, as well as the responsibilities of the present committee.

Institute Policy Committee

The Institute policy committee was appointed in accordance with the requirements in the by-laws, and was ready to consider any matters that might be brought to its attention. However, the board of directors did not find it necessary to refer any questions to the committee.

Committee on Code of Principles of Professional Conduct

The committee has undertaken no revision of the code and no proposals of this sort have been submitted to the committee.

Committee on Constitution and By-Laws

This committee conducted its work by correspondence, and considered and recommended several proposed amendments to the constitution and by-laws of the Institute.

Committee on Economic Status of the Engineer

The committee has met at convenient times during conventions. The committee members have also carried on correspondence relating to the work of the committee. At a meeting held during the winter convention, the committee had for discussion a considerable amount of data, largely in the form of bulletins published by the Bureau of Labor Statistics of the United States Department of Labor. Also the committee had available, by virtue of C. F. Scott's membership on the committee, the accumulated experience of Engineers' Council for Professional Development. As data available were reviewed and discussed, the chairman of the committee made the remark: "The economic status of the engineer is largely a matter determined by each individual engineer according to his particular personal qualifications and the relations these bear to the work he does and to the personalities of those persons with whom and by whom he is employed." Whereupon he was instructed by the committee to write a paper setting forth the reasons leading to the comment made. That paper has been submitted to the technical program committee for use at the summer convention in June, and may be referred to as a part of this report.

Committee on Award of Institute Prizes

Four national and 12 District prizes were awarded in 1937 for papers presented in the calendar year 1936 and for student papers presented during the academic year ending June 30, 1937. These awards were announced in the issues of Electrical Engineering for June, September, October, and November 1937.

The committee considered a large number of papers and the gradings and recommendations of the technical committees which had reviewed the papers. Many papers considered were of a high quality, and, in addition to the national prizes, ten other papers were given honorable mention.

Copies of a revised edition of the pamphlet "National and District Prizes," containing revisions recommended by the committee and approved by the board of directors, were distributed in August 1937.

Committee on Award of Columbia University Scholarships

During February and March 1937, 15 inquiries regarding Columbia University scholarships were received from interested students in some ten institutions. Application forms and information were sent to each of these, but not a single formal application for the scholarship was received.

This is ascribed to the fact that, during May and June 1937, the industries made such a demand for technical graduates that all Columbia University graduates obtained positions in industry immediately upon graduating, and many had been engaged long before commencement.

Edison Medal

The Edison Medal, which is awarded by a committee composed of 24 members of the Institute, was, for 1937, awarded to Gano Dunn "for distinguished contributions in extending the science and art of electrical engineering, in the development of great engineering works, and for inspiring leadership in the profession," and was presented on January 26, 1938, during the winter convention. The medal may be awarded annually "for meritorious achievement in electrical science, electrical engineering, or the electrical arts."

John Fritz Medal

The John Fritz Medal board of award, composed of representatives of the national societies of civil, mining, mechanical, and electrical engineers, awarded the 34th medal (for 1938) to Doctor Paul Dyer Merica, vice-president, International Nickel Company, for "important contributions to the development of alloys for industrial uses."

Lamme Medal

The Lamme Medal committee awarded the medal for 1937 to Doctor Robert E. Doherty, president, Carnegie Institute of Technology, "for his extension of the theory of a-c machinery, his skill in introducing that theory into practice, and his encouragement of young men to aspire to excellence in this field." Arrangements are being made for the presentation of the medal at the annual summer convention in Washington, D. C., June 20–24, 1938. The medal may be awarded annually to a member of the AIEE "who has shown meritorious achievement in the development of electrical apparatus or machinery."

Alfred Noble Prize

This prize, established in 1929, consists of a certificate and a cash award of $500 from the income from a fund contributed by engineers and others to perpetuate the name and achievements of Alfred Noble, past-president of the American Society of Civil Engineers and of the Western Society of Engineers. It may be made to a member of any of the co-operating societies, ASCE, AIME, ASME, AIEE, or WSE, for a technical paper of particular merit accepted by the publication committee of any of these societies, provided the author, at the time of such acceptance, is not over 30 years of age. The award for 1937 was presented to Doctor

G. M. L. Sommerman, research engineer, American Steel & Wire Company, Worcester, Mass.

Washington Award

The Washington Award for 1938 was bestowed upon Doctor Frank B. Jewett, for "inspiring and directing scientific research leading to improvements in the art of communication," and was presented to him at a dinner on May 5, 1938. This award may be made annually to an engineer by the commission of award composed of nine representatives of the Western Society of Engineers and two each of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, and AIEE.

Hoover Medal

The Hoover Medal was established through a trust fund created by a gift from Conrad N. Lauer, and is to be awarded periodically "to a fellow engineer for distinguished public service" by a board representing the national societies of civil, mining and metallurgical, mechanical, and electrical engineers. The last award was made to Doctor Ambrose Swasey in 1936.

Iwadare Foundation Committee

No Iwadare lecturer was chosen to go to Japan for the current year. One Iwadare fellow, Kiyoshi Abe, assistant professor of Kyoto Imperial University, is at present in the United States.

Employment Service

The Institute co-operates with the national societies of civil, mining, and mechanical engineers in the operation of the Engineering Societies Employment Service with its main office in the Engineering Societies Building, New York. Offices are operated in Chicago and San Francisco also. In addition to the societies named, others co-operate in certain of the offices as follows: New York—Society of Naval Architects and Marine Engineers; Chicago—Western Society of Engineers; San Francisco—California Section of the American Chemical Society; and the Engineers' Club of San Francisco.

The service is supported by the joint contributions of the societies and their individual members who are benefited. In addition to the publication of the employment service announcements monthly in Electrical Engineering, weekly subscription bulletins are issued for those seeking positions.

An analysis of this employment service as reported to the national societies is given in table XII.

Table XII. Analysis of Employment Service

Month	Men Registered				Men Placed			
	New York	Chicago	San Francisco	Total	New York	Chicago	San Francisco	Total
1937								
May	288	82	89	459	51	32	25	108
June	310	99	108	517	53	33	26	112
July	233	92	59	384	50	34	16	100
August	206	82	53	341	49	31	25	105
September	205	77	64	346	54	22	16	92
October	212	71	74	357	51	18	22	91
November	185	97	80	362	48	8	12	68
December	179	91	66	336	34	3	13	50
1938								
January	244	90	73	407	37	10	10	57
February	216	58	68	342	30	8	17	55
March	237	96	101	434	33	8	16	57
April	229	135	92	456	25	9	17	51
Total	2,744	1,070	927	4,741	515	216	215	946

American Engineering Council

The American Engineering Council has continued its activities in the wide range of affairs which are found within the scope of its objectives: "to further the public welfare wherever technical and engineering knowledge and experience are involved, and to consider and act upon matters of common concern to the engineering and allied technical professions," and within the interests of its many member-bodies.

The 18th annual meeting of the assembly was held in Washington, D. C., January 13–15, 1938. The eighth conference of engineering society secretaries was held on the 13th.

The four major themes occupying the attention of the assembly were the engineer's economic status, the evaluation of technology, planning of public and private enterprise, and government reorganization. Reports of officers and standing and special committees were presented. Much attention was given to efforts to clarify the objectives and procedures of the Council in order to give engineers a more definite place in the consideration of public questions.

The discussions and actions at the annual meeting and subsequent actions by the executive committee gave the Council a modified program for 1938, consisting of the five principal functions:

I. Public Affairs—Contacts between the engineering profession and the federal government.

II. Public Discussion—Holding of forums, in co-operation with member bodies, for discussion of public problems involving engineering.

III. Engineers' Embassy—Service to members on engineering matters involved in federal government activities.

IV. Publicity—Regular reporting upon above mentioned functions to member bodies.

V. Fact Finding—Surveys and investigations to determine the effects of technology upon employment, relation of engineering to economics in public questions, etc.

A more complete statement of the 1938 program may be found in the May 1938 issue of Electrical Engineering, page 228, and accounts of activities in progress appeared in various issues of that publication during the past year.

United Engineering Trustees, Inc.

This organization manages the Engineering Societies Building and administers certain joint funds for the four founder societies. The American Institute of Chemical Engineers has moved its headquarters into the building, which is now fully occupied.

Provisions have been made for the resumption of annual additions to the depreciation and renewal fund.

A new edition of the "History, Charter, and By-laws" was issued in 1937.

An abstract of the annual report of the United Engineering Trustees, Inc., was published in Electrical Engineering for December 1937, page 1529.

Engineering Foundation

The Engineering Foundation is a joint organization of the national societies of civil, mining and metallurgical, mechanical, and electrical engineers established for "the furtherance of research in science and engineering, and the advancement in any other manner of the profession of engineering and the good of mankind."

The foundation suffered a serious loss in the death of Doctor Ambrose Swasey, its founder, on June 15, 1937.

The foundation has been assisting in a wide range of technical researches sponsored by the founder societies. Some of the principal groups now in progress are: ASCE—soil mechanics and foundations, hydraulics; AIME—alloys of iron, barodynamic problems; ASME—critical pressure steam boilers, fluid meters, lubrication, cottonseed processing, plasticity; AIEE—stability of impregnated paper insulation; AIEE and AWS—welding; University of California—plastic flow of concrete.

Assistance in nontechnical matters related to engineering has been granted to the Engineers' Council for Professional Development and the Personnel Research Federation.

An abstract of the annual report of the Engineering Foundation was published in the December 1937 issue of Electrical Engineering, pages 1529–30.

Engineering Societies Library

The Engineering Societies Library, which was formed by combining the separate libraries of the four national societies of civil, mining and metallurgical, mechanical, and electrical engineers, and the preparation of a composite card catalog, has been expanded as a single engineering library, which probably constitutes the best collection of this type of literature in the United States.

On September 30, 1937, the library had 141,193 volumes, 7,281 maps, and 4,362 bibliographies. Books, pamphlets, and maps totaling 11,003 were received during

the year ending at that time. Current issues of 1,416 periodicals were received. Work progressed rapidly on a classified index to periodicals, and the index now contains more than 187,000 references to articles published since 1927.

Special services rendered by the library include: photoprints, searches, abstracts, translations, bibliographies, book loans by mail, etc.

An abstract of the annual report of the library was published on page 1530 of ELECTRICAL ENGINEERING for December 1937.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

This council was organized in 1932 to engage in activities leading to the enhancement of the professional status of the engineer. It includes three representatives of each of the seven participating organizations: the national societies of chemical, civil, electrical, mechanical, and mining and metallurgical engineers, the Society for the Promotion of Engineering Education, and the National Council of State Boards of Engineering Examiners.

The principal activities of ECPD include programs for the guidance of young individuals thinking of entering the engineering field, the accrediting of curricula of engineering schools, encouragement and assistance to individuals in their engineering and cultural studies during several years after graduation, and the development of criteria for indicating the attainment of the status of an engineer.

At the annual meeting held on October 1, 1937, many additional curricula of engineering schools were accredited, bringing the total number to 445 in 107 schools. The complete list appeared in the November 1937 issue of ELECTRICAL ENGINEERING, page 1418. Seventy-one of the 445 curricula were accredited for limited periods, and will be re-examined as those periods expire. Prior to the date of the annual meeting, the committee on engineering schools had prepared recommendations on 626 curricula in 129 institutions.

Comprehensive excerpts from the reports of the committees on student selection and guidance, engineering schools, and professional training as presented at the annual meeting were published in the November 1937 issue of ELECTRICAL ENGINEERING, pages 1416–19. The report of the committee on professional recognition was referred back to the committee.

At its meeting held on October 28, 1937, the board of directors of the Institute disapproved the recommendations of ECPD: (1) That the minimum definition of an engineer adopted by ECPD be applied as a minimum requirement for admission to the professional grades of membership, and evidence of professional education also be required; and (2) that membership grades be adjusted to conform to the ECPD standard grades of membership.

REPRESENTATIVES

The Institute has continued its representation upon many joint committees and national bodies, with which it co-operates in a wide range of activities of interest and importance to engineers and others.

A list of representatives was published in the September 1937 issue of ELECTRICAL ENGINEERING and in the 1938 Year Book.

FINANCE COMMITTEE

The committee, as usual, recommended a detailed budget to the board of directors, passed upon the expenditures for various purposes, made recommendations regarding delinquent members, and performed the other duties prescribed for it in the constitution and by-laws.

Haskins and Sells, certified public accountants, have audited the books, and their report follows.

The year has been so productive of constructive work throughout every activity of the Institute that the board of directors extends to the District and Section officers, the national committees, and the membership its sincere appreciation of their continuing interest, untiring efforts, and effective services.

Respectfully submitted for the board of directors.

H. H. HENLINE,
National Secretary

May 26, 1938

HASKINS & SELLS
CERTIFIED PUBLIC ACCOUNTANTS

22 EAST 40TH STREET
NEW YORK

May 24, 1938

American Institute of Electrical Engineers,
33 West 39th Street,
New York.

Dear Sirs:

We have made an examination of your balance sheet as of April 30, 1938, and of your recorded cash receipts and disbursements for the year ended that date. In connection therewith, we examined or tested your accounting records and other supporting evidence in a manner and to the extent which we considered appropriate in view of your system of internal accounting control. We present the following financial statements:

Balance Sheet, April 30, 1938 (Exhibit A).
Property and Restricted Funds Securities, Less Reserve for Securities of Doubtful Value (Schedule 1).

Statement of Recorded Cash Receipts and Disbursements of General Fund for the Year Ended April 30, 1938 (Exhibit B).

Statement of Recorded Cash Receipts and Disbursements of Property and Restricted Funds for the Year Ended April 30, 1938 (Exhibit C).

In accordance with the terms of our engagement, members and other debtors were not requested to confirm to us the amounts receivable from them at April 30, 1938, and, in accordance with the usual practice of the Institute, no provision has been made for dues which may prove to be uncollectible.

In our opinion, based upon such examination and subject to the comments in the foregoing paragraph, the accompanying Exhibit A fairly presents your financial condition at April 30, 1938, and the accompanying Exhibits B and C set forth your recorded cash receipts and your disbursements of funds, as indicated, for the year ended that date.

Yours truly,

HASKINS & SELLS

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Exhibit A — Balance Sheet, April 30, 1938

ASSETS			LIABILITIES		
Property Fund Investments:					
One-fourth interest in real estate and other assets of United Engineering Trustees, Inc., exclusive of trust funds		$498,448.48			
Equipment:					
Library—volumes and fixtures	$ 37,296.37				
Office furniture and fixtures (less reserve for depreciation, $28,749.43)	5,695.90				
Works of art, etc.	3,001.35				
Securities—at cost (market quotation value, $8,997.53)—Schedule 1	10,042.53				
Cash (see Exhibit C)	22.47				
Total property fund investments		$554,507.10			
Restricted Fund Investments:					
Securities—at cost (market quotation value, $180,615.66) less reserve for securities of doubtful value—Schedule 1	$206,824.65				
Cash (see Exhibit C)	5,070.95				
Accrued interest receivable	209.16				
Total restricted fund investments		212,104.76			
Current Assets:					
Cash (see Exhibit B)	$ 49,616.89				
Accounts receivable:					
Members—for dues	18,753.01				
Advertisers	140.00				
Miscellaneous	2,124.39				
Accrued interest on investments	2,591.98				
Inventories:					
TRANSACTIONS, etc.	2,082.25				
Text and cover paper	7,231.60				
Work in process (May issue of ELECTRICAL ENGINEERING)	3,443.04				
Badges	1,028.55				
Total current assets		87,011.71			
Total		$853,623.57	**Total**		$853,623.57
			Property Fund Reserve		$554,507.10
			Restricted Fund Reserves:		
			Reserve Capital Fund	$192,002.66	
			Life Membership Fund	9,121.52	
			International Electrical Congress of St. Louis Library Fund	5,357.82	
			Lamme Medal Fund	4,578.03	
			Mailloux Fund	1,044.73	
			Total restricted fund reserves		212,104.76
			Current Liabilities—Accounts Payable		6,079.74
			Deferred Income:		
			Dues received in advance	$ 4,509.21	
			Entrance fees and dues advanced by applicants for memberships	659.04	
			Deferred credits and other unallocated receipts	444.82	
			Subscriptions for TRANSACTIONS received in advance	40.00	
			Reserve for prepaid subscriptions for ELECTRICAL ENGINEERING	8,500.00	
			Total deferred income		14,153.07
			Surplus		66,778.90
			Total		$853,623.57

Property and Restricted Funds Securities, Less Reserve for Securities of Doubtful Value, April 30, 1938

Exhibit A, Schedule 1

	Face Value of Bonds or Number of Shares of Stock	Property Fund (Equipment Replacement)	Restricted Funds: Reserve Capital Fund	Life Membership Fund	International Electrical Congress of St. Louis Library Fund	Lamme Medal Fund	Mailloux Fund	Total
Railroad Bonds:								
Alleghany Corporation 20-year collateral trust convertible 5%, due 1949	$15,000.00		$ 10,627.50					$ 10,627.50
Baltimore & Ohio Railroad Company 6% refunding and general mortgage series C, due 1995	12,000.00		8,940.00			$4,330.00		13,270.00
Central of Georgia Railway Company 5% consolidated mortgage, due 1945	3,000.00		1,477.50					1,477.50
Chicago, Burlington & Quincy Railroad Company 5% first and refunding mortgage series A, due 1971	1,000.00		1,010.00					1,010.00
Chicago & Erie Railroad Company 5% first mortgage, due 1982	1,000.00		1,105.00					1,105.00
Chicago & Northwestern Railway Company 6½%, due March 1, 1936	9,000.00		7,202.50					7,202.50
Cleveland Union Terminals Company 5% sinking fund series B, due 1973	4,000.00	$ 4,010.00						
Florida East Coast Railway Company 5% first and refunding mortgage series A, due 1974 (certificates of deposit)	10,000.00		9,818.75					9,818.75
New York Central Railroad Company 5% refunding and improvement mortgage series C, due 2013	6,000.00		5,742.50					5,742.50
Northern Pacific Railway Company 6% refunding and improvement mortgage series B, due 2047	10,000.00		10,962.50					10,962.50
Pennsylvania Railroad Company 30-year secured serial 4%, due 1944	6,000.00		5,337.50		$1,067.50			6,405.00
St. Louis-San Francisco Railway Company 5% prior lien mortgage series B, due 1950 (certificates of deposit)	6,000.00		5,497.50					5,497.50
Southern Pacific Company Oregon Lines 4½% first mortgage series A, due 1977	1,000.00				996.25			996.25
Texas and Pacific Railway Company general and refunding series B 5%, due 1977	5,000.00			$5,306.25				5,306.25
Western Pacific Railroad Company 5% series A, due 1946 (stamped)	15,000.00		7,225.00					7,225.00
Total railroad bonds—(Forward)		$ 4,010.00	$ 74,946.25	$5,306.25	$2,063.75	$4,330.00		$ 86,646.25

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Property and Restricted Funds Securities, Less Reserve for Bonds of Doubtful Value, April 30, 1938

Exhibit A, Schedule 1 (Concluded)

	Face Value of Bonds or Number of Shares of Stock	Property Fund (Equipment Replacement)	Restricted Funds: Reserve Capital Fund	Life Membership Fund	International Electrical Congress of St. Louis Library Fund	Lamme Medal Fund	Mailloux Fund	Total
TOTAL RAILROAD BONDS—(Forward)		$ 4,010.00	$ 74,946.25	$5,306.25	$2,063.75	$4,330.00		$ 86,646.25
Public Utility Bonds:								
American Gas & Electric Company 5% debenture, due 2028	$ 9,000.00		$ 9,596.25					$ 9,596.25
Georgia Power Company first and refunding mortgage 5%, due 1967	10,000.00		9,725.00					9,725.00
Monongahela-West Pennsylvania Public Service Company 6% debentures, due 1965	8,000.00		8,660.00					8,660.00
New York Telephone Company first and general mortgage 4½%, due 1939	1,000.00						$1,000.00	1,000.00
Philadelphia Company secured 5% series A, due 1967	10,000.00		10,000.00					10,000.00
Texas Electric Service Company 5% first mortgage, due 1960	10,000.00		9,838.75					9,838.75
Total public utility bonds			$ 47,820.00				$1,000.00	$ 48,820.00
Industrial and Miscellaneous Bonds, Etc.:								
Fidelity Union Title and Mortgage Guaranty Company first mortgage certificates (on property 75–79 Prospect Street, East Orange, N. J.), 4%, due 1944	$14,663.00	$ 977.53	$ 13,685.47					$ 13,685.47
General Motors Acceptance Corporation 3¼%, due 1951	7,000.00		7,140.00					7,140.00
New York Steam Corporation 6% first mortgage, due 1947	10,000.00		10,837.50					10,837.50
Total industrial and miscellaneous bonds, etc		$ 977.53	$ 31,662.97					$ 31,662.97
Municipal Bonds:								
City of Detroit public lighting 4½% series A, due 1945	$10,000.00		$ 10,262.50					$ 10,262.50
New York City 4½% corporate stock, due 1957	2,000.00				$2,204.05			2,204.05
Total municipal bonds			$ 10,262.50		$2,204.05			$ 12,466.55
United States Government Bonds and Notes:								
Federal Farm Mortgage 3%, due 1949/44	$12,000.00		$ 12,405.00					$ 12,405.00
Treasury Bonds 3¼%, due 1941	10,000.00		10,650.00					10,650.00
Treasury Bonds 2¾%, due 1947/45	10,000.00		10,409.38					10,409.38
Treasury Notes 2% series B, due September 15, 1942	8,000.00		8,037.50					8,037.50
Total United States Government bonds and notes			$ 41,501.88					$ 41,501.88
Capital Stocks:								
Commonwealth Edison Company	48 shares		$ 2,892.00					$ 2,892.00
Commercial Investment Trust Corporation 4¼% preferred, series of 1935	100 "		10,100.00					10,100.00
Consolidated Edison Company of New York, Inc. $5.00 cumulative preferred	30 "	$ 3,060.00						
International Match Realization Co., Ltd. voting trust certificates for capital shares of International Match Corporation	6 "		2,319.15					2,319.15
Public Service Corporation of New Jersey $5.00 preferred	30 "		2,958.75					2,958.75
United Gas Improvement Company $5.00 preferred	30 "	1,995.00	997.50					997.50
Total capital stocks		$ 5,055.00	$ 19,267.40					$ 19,267.40
Total		$10,042.53	$225,461.00	$5,306.25	$4,267.80	$4,330.00	$1,000.00	$240,365.05
Less Reserve for Securities of Doubtful Value:								
Central of Georgia Railway Company 5% consolidated mortgage, due 1945	$ 3,000.00		$ 1,477.50					$ 1,477.50
Chicago & Northwestern Railway Company 6½%, due March 1, 1936	9,000.00		7,202.50					7,202.50
Florida East Coast Railway Company 5% first and refunding mortgage series A, due 1974	10,000.00		9,818.75					9,818.75
International Match Realization Company, Ltd. voting trust certificates for capital shares of International Match Corporation	6 shares		2,319.15					2,319.15
St. Louis-San Francisco Railway Company 5% prior lien mortgage series B, due 1950	$ 6,000.00		5,497.50					5,497.50
Western Pacific Railroad Company 5% series A, due 1946 (stamped)	15,000.00		7,225.00					7,225.00
Total reserve for bonds of doubtful value			$ 33,540.40					$ 33,540.40
Total securities, less reserve		$10,042.53	$191,920.60	$5,306.25	$4,267.80	$4,330.00	$1,000.00	$206,824.65
Total Property Fund Securities		$10,042.53						
Total Restricted Fund Securities			$191,920.60	$5,306.25	$4,267.80	$4,330.00	$1,000.00	$206,824.65

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Exhibit B — Statement of Recorded Cash Receipts and Disbursements of General Fund for the Year Ended April 30, 1938

Cash on Deposit With the National City Bank of New York, May 1, 1937		$ 51,700.32
Receipts:		
Dues (including $84,762.00 allocated to ELECTRICAL ENGINEERING subscriptions)	$193,344.84	
Advertising	34,842.44	
TRANSACTIONS subscriptions	7,278.99	
ELECTRICAL ENGINEERING subscriptions	14,483.41	
Miscellaneous publications, etc	12,237.45	
Student fees	12,340.50	
Entrance fees	7,798.02	
Membership badges	1,849.21	
Transfer fees	870.00	
Interest on investments, less purchased interest	9,446.50	
Miscellaneous	495.07	
Total receipts		294,986.43
Total		$346,686.75
Disbursements:		
Publication expense:		
ELECTRICAL ENGINEERING	$ 89,285.12	
TRANSACTIONS	6,125.37	
Preprints—technical papers	2,228.72	
YEAR BOOK	6,452.59	
Miscellaneous publications, etc	8,437.87	
Institute meetings	13,537.95	
Institute Sections	34,130.54	
Institute Branches	2,671.66	
Edison Medal committee	197.46	
Finance committee	1,600.00	
Headquarters committee	95.25	
Membership committee	7,642.85	
Standards committee	6,827.46	
Technical committee	171.96	
Forward	$179,404.80	$346,686.75
Total—(Forward)		$346,686.75
Disbursements—(Forward)	$179,404.80	
Traveling expenses:		
Geographical Districts:		
Executive committees	1,947.77	
Vice-presidents	246.03	
Branch counselors	6,550.60	
President's appropriation	821.76	
Board of directors	4,396.59	
National nominating committee	1,062.55	
Administrative expenses	45,564.12	
Geographical Districts—best paper prizes	141.50	
Geographical Districts—initial paper prizes	26.50	
National prizes	6.00	
American Engineering Council	12,000.00	
American Standards Association	1,500.00	
United Engineering Trustees, Inc.:		
Building assessment	11,022.64	
Library assessment	9,313.83	
Library stacks	1,500.00	
Engineering Societies employment service	1,332.96	
Engineers' Council for Professional Development	415.00	
John Fritz Medal	50.00	
National Fire Protection Association—dues	60.00	
United States Committee of International Commission on Illumination	300.00	
Membership badges	1,650.85	
Legal services	250.00	
Retirement salary	2,250.00	
Miscellaneous	256.36	
Transfers to reserve capital fund	15,000.00	
Total disbursements		297,069.86
Cash on Deposit With The National City Bank of New York, April 30, 1938		$ 49,616.89

Exhibit C — Statement of Recorded Cash Receipts and Disbursements of Property and Restricted Funds for the Year Ended April 30, 1938

		Restricted Funds					
	Property Fund (Equipment Replacements)	Reserve Capital Fund	Life Membership Fund	International Electrical Congress of St. Louis Library Fund	Lamme Medal Fund	Mailloux Fund	Total Restricted Funds
Cash on Deposit, May 1, 1937, With East River Savings Bank and The National City Bank of New York	$22.47	$ 306.40	$4,546.42	$ 938.62	$137.33	$48.92	$ 5,977.69
Receipts:							
Interest on bonds, and dividends on stocks			$250.00	$175.00	$240.00	$45.00	$710.00
Interest on bank balances			71.27				71.27
Proceeds from sale of securities		$33,417.54					33,417.54
Life membership fees			404.09				404.09
Transfers from general fund		15,000.00					15,000.00
Total receipts		$48,417.54	$ 725.36	$ 175.00	$240.00	$45.00	$49,602.90
Total	$22.47	$48,723.94	$5,271.78	$1,113.62	$377.33	$93.92	$55,580.59
Disbursements:							
Annual withdrawal authorized in by-laws			$1,477.34				$ 1,477.34
Gold and bronze replicas of Lamme Medal and certificate					$229.30		229.30
Purchase of securities		$48,641.88					48,641.88
All other disbursements				$ 89.43		$71.69	161.12
Total Disbursements		$48,641.88	$1,477.34	$ 89.43	$229.30	$71.69	$50,509.64
Cash on Deposit, April 30 ,1938, With East River Savings Bank and The National City Bank of New York	$22.47	$ 82.06	$3,794.44	$1,024.19	$148.03	$22.23	$ 5,070.95

Five Districts Announce Prize Awards for Papers

District prizes for AIEE papers as announced by five Districts to date include six awards of $25 each, together with appropriate certificates, for initial and Branch papers, and one certificate for best paper. Other District awards will be announced later, as the information becomes available. The awards are for papers presented during 1937, except for Branch papers which may be included in the period from January 1, 1937, to June 30, 1938. Henceforth, according to the revised rules adopted early in 1937, Branch paper prizes will be awarded on the basis of the academic year from July 1 to June 30.

DISTRICT 1

Prize for initial paper was awarded to B. R. Prentice (A'35) for his paper "Fundamental Concepts of Synchronous Machine Reactances," presented at a meeting of the Pittsfield Section, March 30, 1937.

Prize for Branch paper was awarded to Abner Crumb for his paper "Power-Circuit Filters for A-C Generators," presented at the North Eastern District meeting, Buffalo, N. Y., May 7, 1937.

DISTRICT 2

Prize for best paper and prize for initial paper were awarded to F. I. Morgan (A'31) for his paper "An Electrical Governor," presented at a meeting of the Baltimore Section, May 17, 1937.

DISTRICT 6

Prize for Branch paper was awarded to J. L. C. Lof for his paper "The Efficiency of Small Electric Motors," presented at the AIEE Branch convention, North Central District, University of Nebraska, Lincoln, April 22, 1938.

DISTRICT 8

Prize for best paper was awarded to H. H. Skilling (A'28, M'34) and P. deK. Dykes for their paper "Distortion of Traveling Waves by Corona," presented at the Pacific Coast convention, Spokane, Wash., September 1, 1937.

Prize for initial paper was awarded to W. T. Thomson (A'37) for his paper "Resonant Nonlinear Control Circuits," presented at a meeting of the University of California Branch, April 23, 1937. This paper was presented also at the AIEE winter convention, New York, N. Y., January 24–28, 1938.

DISTRICT 10

Prize for best paper and prize for initial paper were awarded to E. O. Lunn (A'32) for his paper "Induction Motors Under Unbalanced Conditions," presented at a meeting of the Vancouver Section, October 4, 1937.

Future Meetings of Other Societies

American Gas Association. October 10–14, Atlantic City, N. J.

American Society of Civil Engineers. Annual convention, July 20–22, Salt Lake City, Utah.

American Society of Mechanical Engineers. Fall meeting, October 5–7, Providence, R. I.

Fuels division meeting, October 13–15, Chicago, Ill.

Illuminating Engineering Society. Annual convention, August 29–September 1, Minneapolis, Minn.

International Congress of Applied Mechanics. September 12–16, Cambridge, Mass.

National Electrical Contractors Association, September 12–15, Detroit, Mich.

National Electrical Manufacturers Association. October 24–28, Palmer House, Chicago, Ill.

National Safety Council. October 10–14, Stevens Hotel, Chicago, Ill.

Society of Automotive Engineers. Sectional regional tractor meeting, September 8–9, Minneapolis, Minn.

National regional fuels and lubricants meeting, October 6–7, Tulsa, Okla.

National aircraft production meeting, October 13–15, Los Angeles, Calif.

Executive Committee of Pacific District Meets

A meeting of the executive committee of the AIEE Pacific District was held at Los Angeles, Calif., May 10, 1938. Those who attended were:

J. P. Jollyman, vice-president, Pacific District
W. F. Grimes, chairman, Los Angeles Section
M. A. Sawyer, secretary, Los Angeles Section
R. O. Brosemer, chairman, San Francisco Section
C. A. Andrews, secretary, San Francisco Section
H. H. Skilling, chairman, District committee on student activities
A. M. Bohnert, secretary, Pacific District

Vice-President Jollyman presided. One of the principal topics discussed was the Institute's forthcoming Pacific Coast convention to be held at Portland, Ore., August 9–12. (Details of the convention may be found elsewhere in this issue.)

The matter of obtaining a traveling speaker to address the various Sections and Branches in the District during the 1938–39 season was referred to the District coordinating committee. The plan of having a traveling speaker was started three years ago, and has resulted in talks by several prominent speakers. The committee also considered several papers of possible interest to the Sections.

Other subjects discussed included the combined summer and Pacific Coast convention to be held at San Francisco, Calif., in 1939, and the proposed California law for licensing engineers.

Additions to Section and Branch Report

F. E. Johnson, Jr., secretary of the AIEE New Orleans Section, has called attention to the fact that the meeting held December 10, 1937, by that Section was a joint Section-Branch meeting and was addressed by students from the Tulane University Branch. This will add one entry to table VII of the "Section and Branch Activities Annual Report for 1937–38" (*EE June '38, p. 263–5*). There were two addresses by students, and the meeting was attended by 90 members and guests. With these added items, the totals at the bottom of the table for all meetings of this type held during the year ending April 30, 1938, will be: 18 Sections, 36 Branches, 67 student talks, and a total attendance of 1,897.

ECPD to Review Engineering Education

Supported by a grant of $10,000 from the Carnegie Foundation for the Advancement of Teaching, the Engineers' Council for Professional Development has arranged for the preparation and publication of a "Report on Engineering Education in 1937" to review and summarize the status of engineering education in that year. This will be based on the great amount of information gathered by the ECPD committee on engineering schools in its investigation for purposes of accrediting engineering curricula in degree-granting institutions of the United States. The work will be in charge of D. C. Jackson (A'87, F'12, past-president) emeritus professor of electrical engineering at Massachusetts Institute of Technology, Cambridge, and formerly president of the Society for the Promotion of Engineering Education. Doctor Jackson has been a member of ECPD and has taken an active part in the study of engineering schools.

The information that will form the basis of the report has been gathered from questionnaires, published material, and the confidential reports of committees that have inspected engineering schools during the past three years. The committee membership is representative of the seven national engineering groups which combine to form ECPD: American Society of Civil Engineers, The American Society of Mechanical Engineers, American Institute of Chemical Engineers, American Institute of Mining and Metallurgical Engineers, AIEE, Society for the Promotion of Engineering Education, and National Council of State Boards of Engineering Examiners.

It is expected that the report will be ready for publication within a year, and copies will be distributed to important engineering libraries and school and society officials.

New York City District Holds Student Convention

On April 28, 1938, a total of 225 students from engineering colleges of metropolitan New York visited the Newark (N. J.) College of Engineering, which was host to the 12th annual AIEE New York City District student convention. Student Branches at the following institutions participated:

Rutgers University, New Brunswick, N. J.
College of the City of New York
Columbia University, New York, N. Y.
Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
Pratt Institute, Brooklyn, N. Y.
New York University, New York, N. Y.
Cooper Union, New York, N. Y.
Stevens Institute of Technology, Hoboken, N. J.
Newark College of Engineering.

Following registration and an inspection of the college laboratories, the visiting groups were conducted to the auditorium of the Public Service Electric and Gas Company, where the technical session was held. The session was opened formally by Convention Chairman Mildred Preen, Newark College of Engineering, who introduced J. W. Johnson, also of the Newark

College, as chairman of the morning session. A. R. Cullimore, president of the college, extended a welcome to the visiting students. J. T. Barron (A'07, F'27) vice-president in charge of electric operation, Public Service Electric and Gas Company, extended greetings to the gathering on behalf of his company.

Papers presented at the technical session were as follows:

1. A New Amplifier, **S. R. Rich,** College of the City of New York.

2. A High-Speed Electronic Circuit Breaker, **Henry Jasik,** Newark College of Engineering.

3. Synchronous Operation of Polyphase Machines With A-C Field Excitation, **Milton Treuhaft** and **J. R. Bejarano,** Columbia University.

4. A Rate-of-Rise Voltmeter to Be Used in Insulating Tests, **J. P. Messana,** Polytechnic Institute of Brooklyn.

5. Circuits and Testing of the PCC Car, **W. R. Lacy,** Pratt Institute.

Adjournment of the technical session was followed by a luncheon, after which D. C. Luce (A'36, M'36) general superintendent of generation of the Public Service Company, described briefly his company's Essex generating station. At 8 p.m. dinner was served in Duffield Hall of the Newark Athletic Club, following which A. F. Dixon (A'14, F'26) chairman of the AIEE New York Section, spoke on the purpose of Student Branches, and urged that students take an interest in Institute affairs after graduation. H. H. Henline (A'19, M'26) national secretary of the Institute, addressed the gathering on Institute activities of the Student Branches.

For papers presented at the morning technical session, Henry Jasik was awarded the first prize of $25, and J. P. Messana was awarded the second prize of $10. The judges were J. H. Pilkington (A'26, M'34) Consolidated Edison Company of New York, Inc., *chairman;* A. G. Oehler (A'18, F'26) editor of *Railway Electrical Engineer;* and R. W. King (M'35) Bell Telephone Laboratories.

The main speaker of the evening, J. L. O'Toole, a vice-president of the Public Service Company, spoke on the organization of that company. Other guests of the convention included J. F. Fairman (A'20, F'35) secretary of the AIEE New York Section, and Professor H. N. Walker (A'27, M'34) of New York University, District chairman of the counselors.

Current Items From American Engineering Council

"Management Is on the Spot"

Under this provocative heading the commerce and industry committee of the Seventh International Management Congress calls attention to the responsibilities of management to review at a great international gathering such problems as "Management's Responsibilities to Society," "The Continuance of Free Enterprise," "Common Ground for Labor and Management," "Labor's Aims and Responsibilities," "Management's Aims and Responsibilities," and "The Public's Concern in Industrial Harmony" (*EE, Nov. '37, p. 1409*).

This Seventh International Management Congress will be held in Washington, September 19–23, 1938, with headquarters at the United States Chamber of Commerce. American Engineering Council by action of the executive committee has accepted the invitation to become one of the sponsoring organizations of this international meeting.

The first Congress was held in Czechoslovakia in 1924 at the call of the government of that newly established nation. The Seventh Congress, the first to be held in the United States, has the approval of the Departments of State and Commerce. Secretary Hull will open the Congress. Secretary Roper will close it. Official invitations to the 16 participating nations have been transmitted by the Department of State through diplomatic channels. It is expected that some 300 delegates from abroad will meet with representatives of management in the United States to discuss together the responsibilities of management and the detailed consideration of technical phases of management in the fields of administration, production, distribution, personnel, agriculture, and the home.

Spring Meeting of AEC Executive Committee

The spring meeting of the AEC executive committee was held in Philadelphia, Pa., on the morning of May 13, preceding the first forum (*EE, June '38, p. 268*). The committee discussed and acted upon a number of public questions and projects. It was voted to record by resolution the approval of the appointment of a special Congressional committee to conduct a fact-finding investigation of the TVA.

It was voted to empower the president of Council to appoint a special committee representing the profession as a whole to co-operate with the staff of the Army and Navy on questions of national defense. This proposal was in accordance with the recommendation voted by the Assembly at the January 1938, meeting.

Favorable consideration was given to a proposal to sponsor a special inquiry into the status of young engineers, under the general direction of the AEC engineering and allied technical societies committee on engineers' economic status, of which Professor J. S. Dodds is chairman, the work to be conducted by the Personnel Research Federation with funds supplied by The Engineering Foundation.

A factual study of the relation of patents to monopoly, proposed by Chairman R. S. McBride of the AEC patents committee was approved, provided the budget for the purpose could be obtained from sources outside of present member organizations.

The executive secretary announced the election of the Engineers Club of Memphis, Tenn., and the Structural Engineers Association of California as members of AEC, bringing the total members of Council up to 52, the largest in its history.

After reviewing many comments of approval on the new form of the *Bulletin*, the executive committee instructed the executive secretary to inquire into the cost of printing the *Bulletin* in quantity so it might be made available to state and local societies for redistribution by them to their members. General approval was expressed of the appearance and content of the *Bulletin*.

The executive committee received many expressions of approval of the proposed series of public forums to be conducted by Council. Consideration was given to several suggestions for extending and developing the forum idea. A number of local organizations has expressed interest in developing the public forums and it was the consensus of opinion of the executive committee that as soon as Council had had more experience in developing the series of major forums it could perform a useful service by the preparation of a handbook on "how to run a forum" for the use of local committees and chairmen. Plans also were discussed for finding ways and means of putting the results of the series of forums in printed form. The public affairs committee, under whose auspices the forums are being directed, will be particularly glad to receive suggestions and subjects for future forums.

Rural Electrification Loans

H. J. Resolution. 679 amends the Rural Electrification Administration Statute and makes $100,000,000 additional available for loans to rural electrical co-operatives through June 30, 1939. It also provides $1,000,000 for additional salaries and expenses of the REA. This Act does not include any new restrictions or regulations except "that materials acquired for rural electrification uses shall be of domestic origin if possible." Otherwise, the basis for loans, construction requirements, and general operating conditions are the same as those now in use.

An interesting implication regarding the expansion of rural electrification is found in title I, section I, item *d* of the Emergency Relief Appropriation Act of 1938 which reads: "construction of—electric transmission and distribution lines or systems to serve persons in rural areas, including projects sponsored by and for the benefit of nonprofit and co-operative associations." Under this authority, it seems entirely possible for the Works Progress Administration to build rural electrification and turn it over to sponsoring co-operative rural electric associations without obligation beyond the usual sponsors' contribution.

Letters to the Editor

CONTRIBUTIONS to these columns are invited from Institute members and subscribers. They should be concise and may deal with technical papers, articles published in previous issues, or other subjects of some general interest and professional importance. ELECTRICAL ENGINEERING will endeavor to publish as many letters as possible, but of necessity reserves the right to publish them in whole or in part, or reject them entirely.

ALL letters submitted for consideration should be the original typewritten copy, double spaced. Any illustrations submitted should be in duplicate, one copy, to be an inked drawing but without lettering, and other to be lettered. Captions should be furnished for all illustrations.

STATEMENTS in these letters are expressly understood to be made by the writers; publication here in no wise constitutes endorsement or recognition by the American Institute of Electrical Engineers.

Graphical Representation of the a-Operator

To the Editor:

The accompanying diagram (figure 1) is a graphical representation of the properties of the a operator which is so widely used for analyzing fault conditions in power networks by the method of symmetrical components. From this diagram the various values of the functions of the a operator are easily obtained and the reason for the particular values readily discerned.

Of interest is the fact that the magnitudes of the functions are either unity or $\sqrt{3}$, as is indicated by the two concentric locus circles. Of further interest is the fact that the functions of the a operator provide a series of operators which will provide phase shifts in 30-degree steps.

A similar diagram can be constructed showing combinations of the operators j and i which will give rotations in 45-degree steps.

Very truly yours,

S. FISHMAN (A'28, M'34)

(Assistant Professor in Electrical Engineering, Newark College of Engineering, Newark, N. J.)

AIEE Publications

To the Editor:

I have been a member of the Institute for 20 years and a casual reader of the JOURNAL and its successor ELECTRICAL ENGINEERING during that time; and I have been most pleased with the change in contents and arrangement that has taken place during the past few years. It is true that the Institute is a professional society, and that the monthly publication should be devoted primarily to the details of electrical research and development. But for every designing or research engineer in the membership there are probably 100 practicing engineers of one kind or another—sales engineers, plant engineers, and management engineers. The more popular and simpler written articles prove especially interesting to this latter group; and very helpful also.

I believe that ELECTRICAL ENGINEERING is now a magazine that is proving useful and stimulating to all of us.

Very truly yours,

N. S. DICKINSON (A'15, M'19)

(Chief Engineer, Motor Sales and Engineering Company, Inc., Newark, N. J.)

Chance and Choice in Engineering

To the Editor:

"Chance and Choice in Engineering," a miniature monograph prepared by Chairman R. L. Sackett of the ECPD committee on selection and guidance, so concisely and effectively presents a matter of interest and importance to the whole engineering profession that I take the liberty of quoting it herewith in full:

It is the business of the engineer to eliminate chance from his work so far as the applications of science will permit. At the same time, boys are taking a chance by choosing an engineering college course without knowing all the facts necessary to sound judgment. Schools, colleges, and the engineering profession should be concerned with reducing the chance of failure and contributing to certainty of success by a co-operative effort to help boys to understand the foundations for a sound choice.

What does engineering education ask of a prospective student?

First: A definite liking for and ability in mathematics, particularly in solving problems.

Second: A scientific curiosity and a deep desire to know *why* and *how* force, electricity, heat, and chemicals act and react as they do.

Third: An interest in drawing, doing things, making things, seeing through them, understanding mechanical, electrical, and other devices, an ability to see in three dimensions or visualization. This latter, valuable aptitude is called by various fancy names, such as "imagination," "creative imagination," seeing "spatial relations," "seeing things with eyes shut."

Fourth: Character, courage, a genuine ambition, supported by dogged determination and many other qualities are either necessary or helpful.

The boy who masters an engineering education has proven that he has capabilities for achievement not only in engineering but in other fields as well, as is attested by the careers of many successful men.

If an engineer is concerned that his profession should raise its standards, then he may give ripe counsel so that able boys with the desirable interests will feel encouraged to apply for admission to an engineering college. Those who are attracted by the spectacular and romantic should understand the nature of the severe discipline ahead of them and make their decision with their eyes open to the realities.

If the engineer is really interested in taking chance out of the choice which boys sometimes take when selecting engineering for a career, the engineer will offer his services to his high school principal. Many local engineering societies are doing a good job. Local sections of the national societies can also help, by organized effort.

I hope that this is in a form that you can print, and also that it may form a basis for discussion or for letters from qualified members in order that this important topic may receive the attention that it merits.

Very truly yours,

CHARLES F. SCOTT (A'92, F'25, HM'29, past president)

(Chairman, Engineers Council for Professional Development, New York, N. Y.)

Cable and Damper Vibration Studies

To the Editor:

In his letter to the editor in the May 1938 issue of ELECTRICAL ENGINEERING Mr. Max Preiswerk states that the mathematical method of calculating the damping action of vibration-free cables as developed in my paper "Cable and Damper Vibration Studies," published in ELECTRICAL ENGINEERING, June 1936, page 600 is incorrect. Mr. Preiswerk states that the results of my calculation do not agree with actual practice and hence the assumptions used to make the problem mathematically

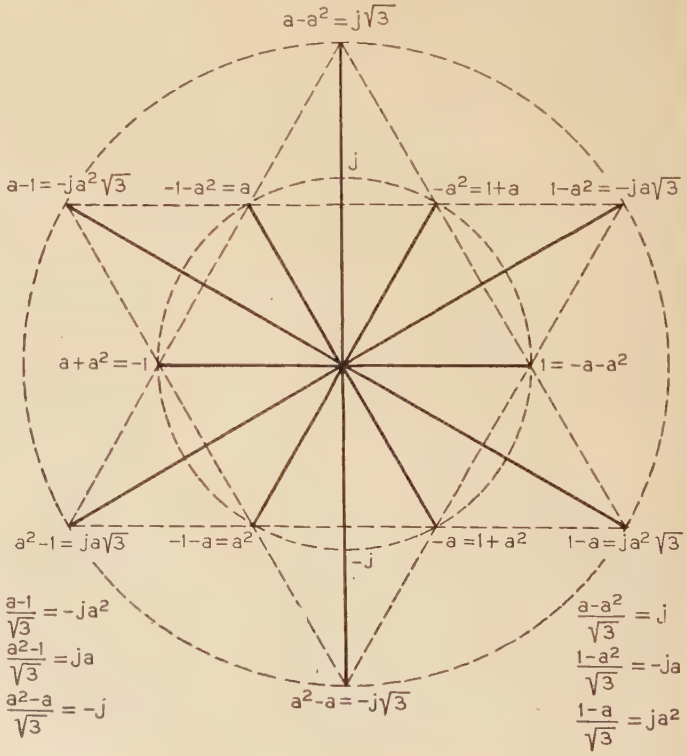


Figure 1. Properties of the a-operator

possible are wrong. Now from the following facts which Mr. Preiswerk mentions in his letter and from the results which were obtained by my theoretical analysis it appears to me that the proposed theory cannot be far in error as I will try to demonstrate by the following:

1. Mr. Preiswerk states in his letter that his vibration-free cables do not vibrate, but that only a slight clicking can be heard. The fact that a slight clicking can be heard appears to me to be inconsistent with the view that the cables never vibrate and seems to be more in accord with the possibility that vibrations tend to get started and are rapidly damped by the energy absorption due to the reaction of the two cables on each other. This appears to be consistent with equation 28 in my paper. This equation shows that any oscillatory disturbance undergoes most rapid attenuation because of the reaction between the two systems.

2. The remark that the amplitudes of traveling waves rapidly diminish as they progress along the conductor is verified by my equations 24, 25, 26, and 27. From these equations it is seen that the damping action due to the reaction between the two systems produces most rapid attenuation of any traveling wave that might be initiated by an external disturbance. This is in perfect agreement with Mr. Preiswerk's observation.

3. Mr. Preiswerk states that in the vibration-free cable the hollow cable and the core cable have such tensions that they try to take different catenary curves. He states that the lifting off and falling back of the hollow cable from the inner core results in damping. The exact mechanism of damping is not very clear from this statement. If a mass is lifted up it acquires more potential energy and this energy will again be transformed into kinetic energy of motion when the mass falls back. Without doubt the slight shock action of the cable, which according to Mr. Preiswerk is not destructive, must be the energy-absorbing mechanism. This effect I have tried to take into account in the equations of motion by a term involving damping proportional to the difference in the velocities of the outer and inner cables. It is true that this may not represent the actual situation exactly but in view of the foregoing two points, it must be at least qualitatively correct.

4. Mr. Preiswerk objects to the method of analysis in which an initial vibration is assumed and the subsequent behavior of the system is studied. If the law of force giving the reaction of the Kaman vortices on the conductor were known, it would be possible to fix the problem to take into account the boundary conditions that the conductor be at rest initially and then to study the effect of the force due to the eddy formation. This mode of attack has interesting possibilities and should bring out some valuable information However, the behavior of the free system showing the manner in which existing disturbances die out gives a qualitative view of the phenomenon.

It is well to mention that Mr. Preiswerk states that his vibration-free cables have now been in practical use for a period of about two years, and are no longer merely a theoretical proposition. It must be realized that the paper in question was written over two years ago and at that time the vibrationless cable was, to the best of my knowledge, still in the experimental stage. A great deal of credit must be given Mr. Preiswerk for the difficult development of his new cable.

Very truly yours,

LOUIS A. PIPES (A'37)

(Research Associate, University of Wisconsin, Madison)

Personal Items

VANNEVAR BUSH (A'15, F'24) has been elected president of the Carnegie Institution of Washington. Doctor Bush is expected to continue his duties as vice-president of Massachusetts Institute of Technology until January 1939. Doctor Bush was born at Everett, Mass., March 11, 1890. In 1913 he was graduated from Tufts College, and in 1916 was awarded the degree of doctor of engineering from Massachusetts Institute of Technology and Harvard University. In 1932 he received the honorary degree of doctor of science from Tufts College, and he is now a member of the board of trustees of that college. Following graduation from Tufts College he entered the testing department of the General Electric Company, Schenectady, N. Y., and during the next year was an instructor in mathematics at Tufts College. In 1915 he became engaged in graduate study at MIT, and in the following year returned to Tufts as assistant professor of electrical engineering. During 1917–18, Doctor Bush carried on research work in submarine detection for the United States Navy; then until 1923 was associate professor of electric power transmission at MIT. From 1917 until 1922 he was also consulting engineer for the American Radio and Research Corporation. In 1923 he was appointed professor of electric power transmission, holding that title until appointed to the position of vice-president and dean of engineering of MIT in 1932. For achievements in electrical engineering he has received the Levy Medal of the Franklin Institute (1928), and he received the AIEE Lamme Medal for 1935. Doctor Bush is a member of the Lamme Medal committee and during the year just ending has been a member of the committees on co-ordination of Institute activities, and Edison Medal; he is also representative on the National Research Council, division of engineering and industrial research. He has served on many other technical and general committees of the Institute. Doctor Bush is a Fellow of the American Academy of Arts and Sciences and American Physical Society, and a member of the Society for the Promotion of Engineering Education, National Academy of Sciences, Phi Beta Kappa, Sigma Xi, and Tau Beta Pi.

C. L. DAWES (A'12, F'35) co-author of the paper "Electrical Characteristics of Suspension-Insulator Units," with Reuben Reiter (A'36) has received the 1937 AIEE national prize award for best paper in theory and research. He is associate professor of electrical engineering at Harvard University, Cambridge, Mass., and a vice-president-elect of the Institute. A biographical sketch of Professor Dawes appeared on page 139 of the March 1938 issue of ELECTRICAL ENGINEERING. In that item Professor Dawes was incorrectly named as chairman of the AIEE Boston Section during the 1937–38 term; in fact he was chairman of that Section during 1936–37.

C. C. CHESNEY (A'94, M'99, F'13) has been elected an honorary member of the Institute. Mr. Chesney was born at Selingsgrove, Pa., October 28, 1863, and was graduated from the Pennsylvania State College in 1885 with the degree of bachelor of science. During the three years following his graduation he taught mathematics and chemistry at Pennsylvania State College and the Doylestown Seminary. In 1888 he joined William Stanley's laboratory staff at Great Barrington, Mass., and in the following year entered the services of the United States Electric Lighting Company, Newark, N. J. In 1890 Mr. Chesney moved to Pittsfield Mass., and became a member of the Stanley

VANNEVAR BUSH

C. L. DAWES

C. C. CHESNEY

Laboratory Company. Three years later he became one of the incorporators of the Stanley Electric Manufacturing Company in the capacity of vice-president and chief engineer. When the Stanley Electric Manufacturing Company was taken over by the General Electric Company in 1907 Mr. Chesney continued as manager and chief engineer of the Pittsfield works. In 1927 he was appointed vice-president of the General Electric Company in charge of manufacturing in all its plants. He retired in 1930 with the title of honorary vice-president. Mr. Chesney has taken an active interest in the affairs of the Institute, serving as manager (1905–08), vice-president (1908–10), and president (1926–27). In 1921 he received the Edison Medal "for early developments in alternating current transmission." He has served as a member of many of the Institute's committees, and as Institute representative on other organizations.

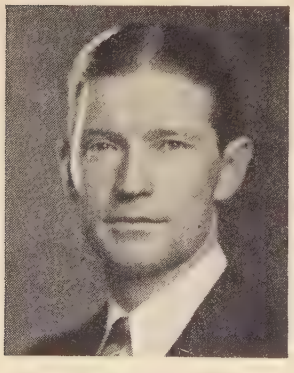
W. B. KOUWENHOVEN (A'06, F'34) has been appointed dean of the school of engineering of The Johns Hopkins University, Baltimore, Md. Doctor Kouwenhoven was born January 13, 1886, at Brooklyn, N. Y. From the Polytechnic Institute of Brooklyn he received the degrees of electrical engineer (1906) and mechanical engineer (1907) and from Karlsruhe Technische Hochschule, Baden, Germany, he received a diploma in engineering in 1913 and the degree of doctor of engineering in 1914. During 1906–07 he was an assistant in physics at the Polytechnic Institute of Brooklyn, and from 1907 until 1910 was an instructor in physics and electrical engineering at the same institution. During 1913–14, he was an instructor in electrical engineering at Washington University, St. Louis, Mo., and in 1914 he joined the faculty of The Johns Hopkins University. Doctor Kouwenhoven was an instructor in electrical engineering from 1914 until 1917, and an associate in electrical engineering from 1917 until 1919. After a leave of absence in 1919, he was appointed associate professor in electrical engineering and held that position until 1930, when he was appointed professor of electrical engineering and assistant dean of the school of engineering. Doctor Kouwenhoven is a director of the Institute, a member of the committees on instruments and measurements, technical program, award of Institute prizes, safety, and electrochemistry and electrometallurgy, and is chairman of the committee on research. From 1931 until 1933, he was a vice-president, and in the past has been member or chairman of several other committees.

J. T. LUSIGNAN, JR. (A'27, M'34) has been appointed executive engineer of the Ohio Brass Company, Mansfield, Ohio. Formerly engineering assistant to the vice-president, Mr. Lusignan now will supervise all engineering activities of the Ohio Brass organization. Born in 1902, at Stockton, Calif., he attended the United States Naval Academy and was graduated from Massachusetts Institute of Technology with the degrees of bachelor of science (1924) and master of science (1925). Later he enrolled in graduate school of Stanford University and received there the degree of doctor of philosophy in electrical engineering in 1928. During 1925–26 he was a research assistant in the high-voltage laboratories of the General Electric Company, Pittsfield, Mass., and following his graduation from Stanford University he returned to that company and remained until 1930. In that year Mr. Lusignan became transmission engineer for the Ohio Brass Company, later becoming chief electrical engineer and engineering assistant to the vice-president. He has been a member of the Institute's committee on power transmission and distribution since 1936, and is active in committee work of the National Electrical Manufacturers Association.

J. B. WHITEHEAD (A'00, F'12) has been appointed director of the school of engineering of The Johns Hopkins University, Baltimore, Md. He has been dean of the school of engineering since 1925. Doctor Whitehead, who was born at Norfolk, Va., August 18, 1872, studied at The Johns Hopkins University, from which he received the degrees of electrical engineer (1893), bachelor of arts (1898), and doctor of philosophy (1902). He was employed first by the Westinghouse Electric and Manufacturing Company, and was associated briefly with the Niagara Falls Power Company and the Pittsburgh Reduction Company. In 1898, he returned to the university as an instructor in electrical engineering, and became associate professor of applied electricity in 1905. He became professor in 1919. Besides having been a manager of the Institute (1924–28) and president (1933–34), Doctor Whitehead has served as chairman or member of many of the Institute's committees, and at present is a member of the committees on Institute activities and the code of principles of professional conduct.

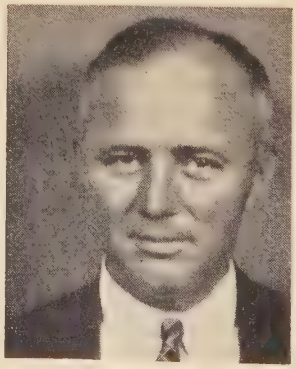
L. N. MCCLELLAN (A'14, M'26) has received honorable mention in the 1937 AIEE national prize awards for best paper in engineering practice with co-authors A. J. A. Peterson (A'16, M'30) and C. P. Garman (A'23, M'26) for the paper "Switchboards For Boulder Power Plant." Mr. McClellan was born at Middletown, Ohio, in 1888, and received the degree of bachelor of science in electrical engineering in 1911 at the University of Southern California. He was then employed by the United States Reclamation Service at Phoenix, Ariz., on the Salt River project as electrical assistant. After serving in various intermediate positions he became engineer in responsible charge of construction and operation of the power system in 1915. During 1917–18 he served as a lieutenant in the United States Army Corps of Engineers, upon his return becoming electrical engineer in the office of the chief engineer of the Reclamation Service at Denver, Colo. Mr. McClellan was employed by the Southern California Edison Company as engineer in the transmission department during 1923–24. Since 1924 he he has been chief electrical engineer for the Bureau of Reclamation at Denver. From 1933 until 1936 Mr. McClellan was a member of the AIEE committee on power transmission and distribution. At present he is a vice-president of the Institute and a member of the committees on automatic stations and applications to mining work.

A. L. COOK (A'02, M'13) has been appointed acting director of the school of science and technology of Pratt Institute, Brooklyn, N. Y. For 25 years Mr. Cook has been head of the department of electrical engineering of that school. Born at Worcester, Mass., in 1878, he was graduated from Worcester Polytechnic Institute with the degree of bachelor of science in electrical engineering in 1901. Following his graduation in 1901, he enrolled in the graduate school at Worcester Polytechnic Institute, at the same time serving as an instructor in electrical engineering, and re-



J. T. LUSIGNAN, JR.

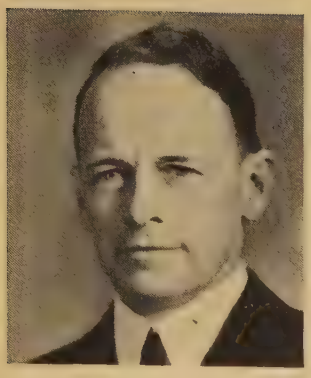
J. B. WHITEHEAD



W. B. KOUWENHOVEN

Bachrach

A. L. COOK



E. L. MORELAND

W. S. GIFFORD

H. R. REED

D. W. ATWATER

ceived the degree of master of science in 1903. From 1907 until 1913 he was an electric power engineer for the consulting engineering firm of Westinghouse, Church, Kerr, and Company, New York, N. Y., and except for that period he has been associated with Pratt Institute continuously since 1903. From 1903 until 1907 Professor Cook was head of the electrical laboratories; became head of the department of industrial electrical engineering in 1913; and has acted as course supervisor in electrical engineering since 1919. Mr. Cook is the author of several textbooks on electrical subjects, and is a member of the Society for the Promotion of Engineering Education.

D. W. Atwater (A'34) has been elected president of the Illuminating Engineering Society for the year beginning October 1, 1938. Mr. Atwater is manager of commercial engineering of the Westinghouse Electric and Manufacturing Company's lamp division, Bloomfield, N. J. Mr. Atwater was born August 14, 1894, at Newark, N. J., and was graduated from Stevens Institute of Technology with the degree of mechanical engineer in 1916. Following two years' service with the United States Army during the World War, he became a specification engineer for the Western Electric Company, New York, N. Y., in 1919. In the following year Mr. Atwater became affiliated with the lamp division of the Westinghouse Company. In 1933 he became assistant manager of the commercial engineering department, and was promoted to the position of manager in the following year. Long active in the Illuminating Engineering Society, Mr. Atwater was for three years general secretary of the Society, and at various times has been member or chairman of several of its committees. For two years he was chairman of the illuminating group of the AIEE New York Section, and since 1935 has been a member of the Institute's committee on production and application of light.

W. S. Gifford (A'16) recently received the gold medal of the National Institute of Social Sciences "in recognition of his services rendered as director of the Council of National Defence; President of the Charity Organization Society of New York; Trustee of [The] Johns Hopkins University, General Education Board, Carnegie Institute of Washington; director of the President's Organization on Unemployment Relief; president of the American Telephone and Telegraph Company, the greatest non-governmental organized service in the United States; and as trustee of numerous educational and scientific foundations." A native (1885) of Salem, Mass., Mr. Gifford was graduated from Harvard University in 1905 with the degree of bachelor of arts. He received the degree of doctor of law from Williams College in 1928 and from Colgate University in 1929, and the degree of doctor of science from Oberlin College in 1929. Following his graduation from Harvard, Mr. Gifford became assistant secretary and treasurer of the Western Electric Company, Chicago, later becoming chief statistician of that company in 1911. He became vice-president of the Western Electric Company in 1919. He has been president of the American Telephone and Telegraph Company since 1925, and a director of several other organizations. Mr. Gifford has been particularly active in civic and governmental activities. He is a member of the American Philosophical Society and the American Association for the Advancement of Science.

E. L. Moreland (A'11, F'21) has been appointed dean of engineering of the Massachusetts Institute of Technology, Cambridge. Dean Moreland was born at Lexington, Va., in 1885, and received the degrees of bachelor of arts (1905) and master of science (1908) from The Johns Hopkins University and Massachusetts Institute of Technology, respectively. Upon his graduation in 1908 he entered the engineering firm of D. C. and William B. Jackson, which in 1919 became the firm of Jackson and Moreland. During the World War Dean Moreland served as captain and later as major of engineers in the United States Army, and after the War was appointed technical executive of the War Damage Board. He has served since 1935 as head of the department of electrical engineering at MIT. At present Dean Moreland is a member of the Institute's committees on standards and education and is alternate on the electrical standards committee of the American Standards Association and the United States National Committee of the International Electrotechnical Commission. In addition he has served as a member of the Institute's committees on electrical machinery, power generation, transportation, technical program, and Institute policy. He is a fellow of the American Academy of Arts and Sciences and a member of the American Society of Civil Engineers, the American Society of Mechanical Engineers, and Society for the Promotion of Engineering Education, as well as several honorary scientific societies.

H. R. Reed (A'28, M'34) co-author of the paper "Induction Motors on Unbalanced Voltages," with R. J. W. Koopman (A'36) has received the 1937 AIEE national prize award for initial paper. Professor Reed was born in 1904 at Minneapolis, Minn., and received the degrees of bachelor of science (1925) and master of science (1927) in electrical engineering at the University of Minnesota and the professional degree of electrical engineering at South Dakota State College (1930). During 1927–29 Professor Reed served as instructor and assistant professor of electrical engineering at South Dakota State College, was appointed to the faculty of the Michigan College of Mining and Technology, Houghton, as assistant professor in 1929, and in 1932 was promoted to associate professorship. He was employed in the engineering department of the Electric Machinery Manufacturing Company, Minneapolis, Minn., for a brief period in 1926; as an electrical tester for the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., in 1929; and as engineer in the United States Army Corps of Engineers in 1930 at Kansas City, Mo. Professor Reed is a member of Sigma Xi, Tau Beta Pi, Eta Kappa Nu, and the Society for the Promotion of Engineering Education.

L. F. Adams (A'09, M'26) has been made manager of the newly formed standards department of the General Electric Company, Schenectady, N. Y. In his new capacity Mr. Adams also will act as assistant to vice-president. Born at Milesburg, Pa., in 1885, he was graduated from Pennsylvania State College with the degree of bachelor of science in electrical engineering in 1906, following which he was employed in the testing department of the General Electric Company. One year later he returned to Pennsylvania State College as an instructor, and in 1909 was awarded the degree of electrical engineer. In the same year Mr. Adams returned to the employ of

the General Electric Company at Schenectady, where he has remained in various positions. Since 1929 he has been in the commercial general department of the company. Mr. Adams has been a member of the United States National Committee of the International Electrotechnical Commission, and has been active in the National Electrical Manufacturers Association.

C. C. Carr (A'30) has been made acting head of the department of electrical engineering and acting course supervisor in electrical engineering at Pratt Institute, Brooklyn, N. Y. Mr. Carr was born May 4, 1898 at Newburgh, N. Y., and was graduated from Rensselaer Polytechnic Institute in 1918. In 1919 he became an electrical draftsman for Newburgh Shipyards, Inc.,

C. C. CARR

Newburgh, N. Y., and in the following year was appointed instructor in electrical technology at Pratt Institute and was placed in charge of the electrical laboratory. He is a member of the Society for the Promotion of Engineering Education.

F. C. Landers (A'19) has become vice-president and general manager of the Central Ohio Light and Power Company, Findlay. Mr. Landers was born in 1882 at Lockport, N. Y., and attended Belfast (Ireland) Technical Institute. Prior to 1920 he was superintendent of the western division of the Niagara, Lockport, and Ontario Power Company. In 1920 he became associated with the management department of Day and Zimmerman, Inc., and managed one of the properties of that company in Maryland. Later he became vice-president and general manager of the Valdosta Lighting Company and Ware County (Ga.) Light and Power Company, going to Florida in 1926 to become vice-president and general manager of the General Public Utilities Company in Miami and West Palm Beach. In 1929 he resigned his position with the General Public Utilities Company to take charge of the Louisiana Ice and Utilities Company and the Southwest Utilities Company, with properties located in Louisiana, Mississippi, and Texas. He continued in charge of those companies until his recent transfer to the Central Ohio Light and Power Company.

R. J. W. Koopman (A'36) co-author of the paper "Induction Motors on Unbalanced Voltages," with H. R. Reed (A'28, M'34) has received the 1937 AIEE national prize award for initial paper. Professor Koopman was born at St. Louis, Mo., in 1905, and received the degree of bachelor of science in engineering at the University of Missouri in 1928. In 1933 he received the degree of master of science in electrical engineering at Yale University. He was a Gregory Scholar in electrical engineering at the University of Missouri in 1934–35. After graduation in 1928 Mr. Koopman was employed by the General Electric Company, Schenectady, N. Y., where he completed the test course and later worked in the test office on special assignments. Upon leaving the General Electric Company in 1931 he became an instructor in electrical engineering at Yale University. Later he was employed by the Century Electric Company, St. Louis, Mo., in 1934. Before being appointed to his present position as assistant professor of electrical engineering at the University of Kansas, Lawrence, he was instructor in electrical engineering at the Michigan College of Mining and Technology, Houghton. Professor Koopman is author or co-author of several other technical papers and articles. He is a member of Sigma Xi, Tau Beta Pi, and Eta Kappa Nu.

J. H. Hagenguth (A'28) has received honorable mention in the 1937 AIEE national prize award for best paper in theory and research. Mr. Hagenguth, a native (1901) of Greipwald, Germany, was graduated in 1925 as diplomingenieur from the Technische Hochschule, Munich, Germany. Following his graduation he spent a year in conducting a power survey with the Kraftwerke Westsachsen. In 1926 he entered the employ of the General Electric Company, Pittsfield, Mass., in the transformer testing department. From 1927 until 1933 he was engaged in the power transformer engineering department, where he was active in transformer design, cooperated in the development of the shielded transformer and the investigation of transients in transformers. In 1933 Mr. Hagenguth joined the staff of the high-voltage engineering laboratory of the General Electric Company, and at present is in charge of that laboratory. The paper for which he received honorable mention is entitled "Short-Time Spark-Over of Gaps," and was presented at the AIEE 1937 winter convention. Mr. Hagenguth is author or co-author of several other technical papers and articles.

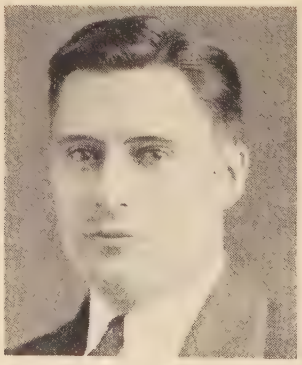
A. C. Moorhaus (A'32) recently was elected a vice-president of the Cincinnati Gas and Electric Company, Cincinnati, Ohio. Mr. Moorhaus was born October 20, 1887, at Cincinnati. In 1912 he became general manager and secretary of the Scioto Valley Railway and Power Company, holding those positions until 1924, when he became purchasing agent for the Cincinnati Gas and Electric Company. In 1930 he was appointed acting general manager, a position he held until his recent election to the vice-presidency.

Howard Dingle (A'07) recently was elected president of the American Gear Manufacturers Association. Mr. Dingle is president of the Cleveland Worm and Gear Company, Cleveland, Ohio. He was born at Asbury Park, N. J., in 1883, and received the degree of mechanical engineer in electrical engineering at Cornell University in 1905. From 1910 until 1918 he was a district manager for the Crocker-Wheeler Electrical Manufacturing Company. In the latter year he became president and treasurer of the Dingle-Clark Company, remaining in that position for six years. In 1924 he became vice-president and general manager of the Cleveland Worm and Gear Company, and has been president since 1927. He is a member of the Society of Automotive Engineers.

Bachrach

A. C. MOORHAUS

F. C. LANDERS



R. J. W. KOOPMAN

HOWARD DINGLE

A. P-T. Sah (A'35, M'36) has received honorable mention in the 1937 AIEE national prize award for best paper in theory and research for his paper "Dyadic Algebra Applied to 3-Phase Circuits." Doctor Sah, who formerly was a visiting professor of the electrical engineering faculties of both the Ohio State University and Massachusetts Institute of Technology, was born in 1902 at Foochow, China, and after receiving the degree of bachelor of arts at Stanford University in 1924, enrolled in the electrical engineering school of Worcester Polytechnic Institute, where he received the degrees of electrical engineer (1925) and doctor of science (1927). For one year after his graduation in 1927 he was affiliated with the Westinghouse Electric and Manufacturing Company at East Pittsburgh, Pa., following which he became chief engineer of the China Radio Corporation, Tientsin. In 1928 he was appointed assistant professor of electrical engineering and physics at Tsing Hua University, Peiping, and in the following year received his full professorship. In 1936 Doctor Sah returned to the United States as visiting professor of electrical engineering at The Ohio State University and Massachusetts Institute of Technology. In 1937 he returned to China to become president of the National University of Amoy. Since 1935 he has served as a member of the Chinese National Electrotechnical Committee, affiliated with the International Electrotechnical Commission, and is a member of several Chinese scientific societies.

Eugene Peterson (M'26) co-author of the paper "Magnetic Generation of a Group of Harmonics," with J. M. Manley and L. R. Wrathall, has received honorable mention in the 1937 AIEE national prize award for best paper in theory and research. Born in New York, N. Y., in 1894, Mr. Peterson attended Cornell University, and received the degree of electrical engineer at the Polytechnic Institute of Brooklyn in 1917. He then pursued graduate work at Columbia University, receiving the degrees of master of arts in 1923 and doctor of philosophy in 1926. From 1915 until 1917 he was employed by the Electrical Testing Laboratories, New York, and following a two-year period of service in the Signal Corps of the United States Army, he became associated with the Western Electric Company in 1919. Mr. Peterson has been a member of the technical staff of the Bell Telephone Laboratories since 1925, and at present is circuit research engineer, engaged in studies of carrier-communication systems and nonlinear circuits. During 1924–25 he was a lecturer on electric oscillations at the Polytechnic Institute of Brooklyn, and since 1935 has been a lecturer on electronics at Columbia University. Mr. Peterson is a member of the Institute of Radio Engineers and Sigma Xi.

R. D. Evans (A'21, M'26) with coauthor A. C. Monteith (A'25) has received honorable mention in the 1937 AIEE national prize award for best paper in engineering practice for the paper "System Recovery Voltage Determination By Analytical and A-C Calculating Board Methods." Mr. Evans was born in 1892 at Springwater, Wis., and received the degree of bachelor of science in electrical engineering at the University of Oklahoma in 1914, following which he entered the employ of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., as a general engineer. He has been affiliated with that company continuously, and recently was made consulting transmission engineer for the company. Mr. Evans has been a member of the Institute's committee on power transmission and distribution since 1924, and at present is chairman of that committee. He was a member of the committee on communications from 1924 until 1934. He has presented several papers before the Institute, principally on transmission-line calculations, power-system stability, and network theory, and is co-author of a textbook on the theory of symmetrical components. In 1929 he was awarded the Triennial Montefiore prize jointly with C. F. Wagner (A'20, M'27) for contributions to the theory of power-system stability.

G. M. L. Sommerman (A'31, M'37) has received honorable mention in the 1937 AIEE national prize awards for best paper in theory and research for his paper "Properties of Saturants for Paper-Insulated Cables." For the same paper he was awarded the Alfred Noble prize for 1937. Doctor Sommerman was born in 1909, at Baltimore, Md., and received the degrees of bachelor of engineering (1929) and doctor of engineering (1933) at The Johns Hopkins University. Following his graduation in 1929 he became a research assistant at that institution, devoting his attention to investigations sponsored by the former National Electric Light Association, and in the following year enrolled in the graduate school of electrical engineering. In 1931 he became an assistant physicist for the Consolidated Gas, Electric Light, and Power Company of Baltimore, and in 1934 joined the research engineering staff of the American Steel and Wire Company, where he has been in charge of fundamental researches on properties of materials for use in high-voltage cables. Doctor Sommerman is a member of the Institute's committees on research and instruments and measurements. He has been an active member of the committee on electrical insulation of the division of engineering and industrial research of the National Research Council. He is a member of several scientific societies.

A. J. A. Peterson (A'16, M'30), with coauthors L. N. McClellan (A'14, M'26) and C. P. Garman (A'23, M'26) has received honorable mention in the 1937 AIEE national prize award for best paper in engineering practice for the paper "Switchboards for Boulder Power Plant." Mr. Peterson was born at Pittsburgh, Pa., in 1892, and was graduated from Carnegie Institute of Technology with the degree of bachelor of science in electrical engineering. Following his graduation he was employed by the Carnegie Steel Company as assistant to the electrical engineer in 1913. In the following year he became a switchboard engineer for the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., where he remained until 1917. During the World War he served in the United States Army, and at the end of the war was employed by the Pennsylvania Railroad Company in 1919. Since 1921 Mr. Peterson has been a switchboard engineer in the switchboard engineering department of the Westinghouse Company.

W. P. Holben (A'20, M'27) has received honorable mention in the 1937 AIEE national prize award for initial paper, for his paper "A Review of Overhead Secondary Distribution." Born at Allentown, Pa., in 1892, Mr. Holben was graduated from Pennsylvania State College with the degree of bachelor of science in 1916, following which he became associated with the Union Switch and Signal Company, Swissvale, Pa. After serving in the United States Army during the World War, he returned briefly to the employ of the Union Switch and Signal Company, and was engaged briefly in railway electrification work, before becoming affiliated with William H. Taylor and Company, Allentown. During 1924–25 Mr. Holben was assistant to the distribution engineer for the Pennsylvania Power and Light Company, and in the latter year joined the engineering staff of the Philadelphia Company, Pittsburgh, Pa., and the Byllesby Engineering and Management Corporation. He is now engaged in the engineering and construction department of the Duquesne Light Company, an affiliated organization, with headquarters at Pittsburgh.

C. P. Garman (A'23, M'26) co-author of the paper "Switchboards for Boulder Power Plant," with L. N. McClellan (A'14, M'26) and A. J. A. Peterson (A'16, M'30) has received honorable mention in the 1937 AIEE national prize award for best paper in engineering practice. Mr. Garman was born in 1888 at Dayton, Ohio, and received his technical education through extension courses of the University of California. After holding several positions for short periods, Mr. Garman became superintendent of the test department of the Dayton Power and Light Company in 1913, remaining there until 1920, when he went to Los Angeles to become junior electrical engineer for the Bureau of Power and Light. For the past eight years he has been assistant engineer in design, and when construction work was started at Boulder Dam he was appointed by the Bureau of Power and Light to co-operate with the government in the design of Boulder Canyon power plant and the preparation and specifications for its machinery and equipment.

I. F. Kinnard (A'21, M'28) co-author of the paper "Development of a Modern Watt-Hour Meter," with H. E. Trekell (A'35) has received honorable mention in the 1937 AIEE national prize award for best paper in engineering practice. Mr. Kinnard was born in Ontario, Canada, in 1891, and received the degree of bachelor of science in electrical engineering from Queen's University. After two years of advanced study at Queen's University and the University

of Glasgow (Scotland), he became a research engineer for the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., in 1919. In 1923 he became electrical engineer at the West Lynn (Mass.) works of the General Electric Company, where he became engaged in research work on permanent magnets, watt-hour meters, and various other electrical instruments. In 1927 he was appointed assistant chief engineer of the West Lynn works, later being assigned to the position of executive engineer.

E. E. Dorting (A'13, M'22) recently was made assistant engineer in the office of the chief engineer of the Interborough Rapid Transit Company, New York, N. Y. A native (1889) of New York, Mr. Dorting attended Stevens Institute of Technology before entering the employ of the Westinghouse Lamp Company, Bloomfield, N. J., as a student engineer in 1908. He remained with that company until 1911, when he became factory engineer for the Heany Lamp Company, Weehawken, N. J. Mr. Dorting became assistant chief tester for the Edison Storage Battery Company, West Orange, N. J., in 1913, but remained there for only one year before becoming affiliated with the Interborough Rapid Transit Company as lighting engineer. He held that position for almost 24 years. Mr. Dorting is a member of the Illuminating Engineering Society and has been active in the committee work of that society.

A. C. Monteith (A'25) with co-author R. D. Evans (A'21, M'26) has received honorable mention in the 1937 AIEE national prize award for best paper in engineering practice for the paper "System Recovery Voltage Determination By Analytical and A-C Calculating Board Methods." Mr. Monteith was born in 1902 at Brucefield, Ont., Canada, and received the degree of bachelor of science from Queen's University. In 1922 he took the student course offered by the Canadian Westinghouse Company, Hamilton, Ont., and following his graduation was selected for the graduate student course and sent to the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. Upon completion of the student course Mr. Monteith was made a general engineer for the company, and he has remained there continuously for more than 14 years.

L. S. Harrison (M'19) has resigned his position as assistant to the president of the International Business Machines Corporation, New York, N. Y., to establish consulting engineering offices in New York. Mr. Harrison will specialize in problems in industrial research, and has become associated with the Technical Research Products Corporation. He was resident agent of the General Electric Company at Trenton, N. J., from 1919 until 1923, when he entered the employ of the International Business Machines Corporation as field engineer, later holding various other positions until 1932. In that year he was placed in charge of research development and engineering. In 1936 Mr. Harrison became assistant to the president and remained in that capacity until his resignation. He has been retained by the corporation on a consulting basis.

H. E. Trekell (A'35) co-author of the paper "Development of a Modern Watt-Hour Meter," with I. F. Kinnard (A'21, M'28) has received honorable mention in the 1937 AIEE national prize award for best paper in engineering practice. Mr. Trekell is a native (1910) of Wellington, Kans., and an electrical engineering graduate of Kansas State University in the class of 1931. In 1932 he was employed by the General Electric Company on the test course at the Schenectady (N. Y.) works, and upon completion of the test course was assigned to the company's advanced course in engineering. In 1934 Mr. Trekell was transferred to the engineering department of the West Lynn (Mass.) works of the General Electric Company, where he became engaged in work on watt-hour meters.

H. C. Gardett (A'07, M'19) recently was advanced to the position of assistant chief electrical engineer and assistant general manager of the Bureau of Power and Light of the City of Los Angeles, Calif. Mr. Gardett, previously design and construction engineer, was born in California in 1878, and is an electrical-engineering graduate of the University of California in the class of 1904. In 1905 he became a meter inspector for the Pacific Electric Railway Company, and two years later became associated with the consulting engineering firm of E. F. Scattergood (A'08, F'13). Mr. Gardett became associated with the Bureau of Power and Light of the City of Los Angeles in 1912 as an assistant electrical engineer. He was placed in charge of the design and construction department in 1917.

J. A. Cranston (A'08) recently retired from active service as commercial vice-president of the General Electric Company, San Francisco, Calif. Mr. Cranston was born April 7, 1862 at Bayfield, Ont., Canada, and first became identified with the electrical industry in 1889, when he joined the Thomson-Houston Company at St. Paul, Minn. Shortly after the Thomson-Houston Company became a part of the General Electric Company in 1892, Mr. Cranston became manager of the Northwest territory of the new company, with headquarters at Portland, Ore. In 1923 he went from Portland to San Francisco to become Pacific Coast manager, and in the same year was elected a commercial vice-president of the General Electric Company.

B. R. Prentice (A'35) has received honorable mention in the 1937 AIEE national prize award for initial paper for his paper "Fundamental Concepts of Synchronous Machine Reactances." A native (1906) of Clifton, Kans., Mr. Prentice received the degree of bachelor of science in electrical engineering at Kansas State College in 1930, following which he was employed by the General Electric Company on its test course. In 1932 he was assigned to the company's advanced course in engineering, and in the following year was made a supervisor of one of the advanced courses. Since 1935 he has been in charge of the company's advanced course in engineering.

Willard Champe (A'25, M'35) has become electrical engineer for the City of Toledo (Ohio) in the division of engineering and construction. Mr. Champe has been employed in the electrical engineering department of the Commonwealth and Southern Corporation, Jackson, Mich., and formerly (1931–36) was an assistant editor on the staff of Electrical Engineering. He is co-author of a paper entitled "System Analysis For Petersen Coil Application," presented at the recent AIEE summer convention at Washington, D. C.

H. L. Doherty (A'98, F'13) recently received the honorary degree of doctor of science from the University of Miami (Fla.). In receiving the degree, Doctor Doherty was cited as "a pioneer in the fight to prevent waste of our resources of natural gas and petroleum." A few months ago Doctor Doherty was awarded the Anthony F. Lucas medal of the American Institute of Mining and Metallurgical Engineers, relative to which a biographical sketch appeared on page 44 of the January 1938 issue of Electrical Engineering.

G. W. Vinal (M'19) received the Gaston Plante Medal of the Société Française des Electriciens at the recent AIEE summer convention in Washington, D. C. A previous item (*EE, Feb. '38, p. 85*) announcing the award of the medal to Doctor Vinal contained two errors. That item incorrectly stated that he received from Wesleyan University the degrees of bachelor of arts in 1909 and bachelor of science in 1936. These degrees should have been given as master of arts and doctor of science, respectively.

Gano Dunn (A'91, F'12) recently received the honorary degree of doctor of science from Columbia University. Doctor Dunn, president of the J. G. White Engineering Corporation, New York, N. Y., was awarded the AIEE Edison Medal for 1937 at the last winter convention, relative to which a biographical sketch appeared on page 44 of the January 1938 issue of Electrical Engineering.

L. B. Bonnett (A'18, M'25) has become assistant engineer of design and planning of the Consolidated Edison Company of New York, Inc., New York, N. Y. Mr. Bonnett became associated with the Brooklyn Edison Company in 1923 as inside plant engineer in the inside plant bureau, electrical engineer's department. He held that position until 1926, when he went to the purchasing department as purchasing agent.

E. H. Lewis (A'25, M'32) recently was elected first vice-president of the Missouri Association of Public Utilities. Mr. Lewis is vice-president of the Union Electric Company of Missouri, Webster Groves, and has been in the service of the Union Electric Company and its affiliates since 1915.

A. E. FRENCH (A'36) recently was appointed head of the department of technical electricity, New York State School of Agriculture, Alfred University, Alfred, N. Y. Mr. French is a native (1910) of Avoca, N. Y. He attended the Rochester (N. Y.) Athenaeum and Mechanics Institute and was graduated from Clarkson College with the degree of bachelor of science in 1934. Since 1935 he has been an assistant electrical engineer for the Eastman Kodak Company, Rochester.

W. J. HOLMAN, JR. (A'30) recently was declared a winner in a national competition for the Alfred P. Sloan Foundation fellowship for a year's graduate study in business administration and economics at Massachusetts Institute of Technology. Since 1933 Mr. Holman has been assistant district manager of the Newburgh district of the Central Hudson Gas and Electric Corporation, and for a time was an instructor in electrical engineering at Yale University.

W. H. HARRISON (A'20, F'21) recently received the honorary degree of doctor of engineering from the Polytechnic Institute of Brooklyn (N. Y.). He is vice-president and chief engineer of the American Telephone and Telegraph Company, New York, N. Y., and president of the Institute during 1937–38. A biographical sketch of Doctor Harrison appeared on page 231 of May 1938 issue of ELECTRICAL ENGINEERING.

H. E. DEARDORFF (A'37) recently was awarded a James H. McGraw prize of the Edison Electric Institute for a paper "The Gathering and Evaluation of Data for Improving 4-Kv Distribution System Operation." Mr. Deardorff is technical engineer for the Dayton Power and Light Company, Dayton, Ohio, and has been employed by that company and its affiliates since 1917.

SIDNEY GOLDSMITH (A'28) has been awarded a James H. McGraw prize of the Edison Electric Institute as co-author of a paper "A New Technique in the Maintenance of Oil Circuit Breakers." Mr. Goldsmith is an operating engineer for the Cincinnati Gas and Electric Company, Cincinnati, Ohio.

H. B. TAYLOR (M'26) recently was elected president of the Navy League of the United States. Mr. Taylor maintains consulting engineering offices at Philadelphia, Pa., and has long been identified with hydraulic engineering and some of the major water power developments in the United States and elsewhere.

F. M. FEIKER (M'34) recently was awarded the honorary degree of doctor of engineering by Worcester Polytechnic Institute. Doctor Feiker received the degree of bachelor of science in electrical engineering at that institution in 1904. At present he is executive secretary of the American Engineering Council, Washington, D. C.

R. W. SORENSEN (A'07, F'13) recently was awarded the honorary degree of doctor of science by the University of Colorado. Doctor Sorensen is professor of electrical engineering at California Institute of Technology, Pasadena. He is a director and past vice-president of the Institute, and has served as a member of several of its committees.

E. F. W. ALEXANDERSON (A'04, F'20) recently was awarded the honorary degree of doctor of philosophy *in absentia* by the Royal University of Upsala, Sweden. Doctor Alexanderson is a consulting engineer for the General Electric Company, Schenectady, N. Y., and has been affiliated with that company since 1902.

C. C. PAYNE (A'29, M'38) recently was appointed deputy electrical engineer in the Municipal Electricity Supply Department, Singapore, Straits Settlement. Mr. Payne has been control engineer for the Central Electricity Board of the Mid-East England area, Leeds, Yorkshire, England.

G. E. HOLLAND (A'34) has become assistant sound engineer for the United States Army Motion Picture Service, St. Louis, Mo. Mr. Holland formerly was junior electrical engineer for the Farm Security Administration, Washington, D. C.

L. P. MORRIS (A'30) has become development engineer for the Crowe Nameplate and Manufacturing Company, Chicago, Ill. Formerly Mr. Morris was radio development engineer for Sparks-Withington Company, Jackson, Mich.

R. S. MEYERS (A'37) now is manager of the American Automatic Alarm Company, Baltimore, Md. Formerly Mr. Meyers was assistant plant engineer for the American District Telegraph Company, New York, N. Y.

J. W. POBST (A'37) recently became affiliated with the Appalachian Electric Power Company, Switchback, W. Va. Mr. Pobst has been a student engineer for the General Electric Company, Schenectady, N. Y.

VINCENT EMANUEL (A'34) now is employed by the Stanolind Oil and Gas Geophysical Laboratory, Tulsa, Okla. Formerly Mr. Emanuel was an observer for the Western Geophysical Company, Los Angeles, Cal.

F. E. LEGGETT (A'32) has become chief draftsman for S. J. Welch, architect, Pensacola, Fla. Formerly Mr. Leggett was draftsman for the State-Wide Highway Planning Survey, Florida State Road Department, Tallahassee.

V. M. CATALDO (A'37) recently was employed by the Porto Rico Reconstruction Administration, Guayama, Porto Rico. Mr. Cataldo formerly was employed by Sears Roebuck and Company, New York, N. Y.

C. R. BOOTHBY (A'29) has become a research engineer for the Electric Auto-Lite Company, Toledo, Ohio. Mr. Boothby previously was employed by the Westinghouse Electric and Manufacturing Company, Springfield, Mass.

J. C. PATTERSON (A'31) has become supervisor of telegraph and signals in the New York division of the Pennsylvania Railroad Company, Jersey City, N. J. He formerly held a similar position at Washington, D. C.

H. R. ANDERSON (A'27, M'36) transmission engineer for the Loup River Public Power District, Columbus, Nebr., recently resigned to join the staff of the Federal Power Commission, Washington, D. C.

B. G. OLVING (A'26) now is employed by The McGraw Electric Company, Elgin, Ill. Mr. Olving has been development engineer for the Safety Car Heating and Lighting Company, New Haven, Conn.

M. O. ZIGLER (A'37) now is employed by the Central New York Power Corporation, Syracuse, N. Y. Formerly Mr. Zigler was an electrical engineer for the Federal Power Commission, Denver, Colo.

F. W. BLISS (A'30) recently was re-elected to serve his third consecutive term as president of the Engineering Societies of New England, Inc., Boston, Mass.

A. R. ROBISON (A'12, M'20) recently resigned as vice-president and general manager of the Central Ohio Light and Power Company, Findlay.

K. E. GORDON (A'30) recently became assistant engineer for the New England Power Service Company, Malden, Mass.

R. L. BERTOLACCI (A'19) has been employed in the valuation department of the Duquesne Light Company, Pittsburgh, Pa.

Obituary

STEPHEN JOSEPH CONNOLLY (A'08) construction engineer for the Western Public Service Company, Scottsbluff, Nebr., died January 29, 1938. Mr. Connolly was born July 21, 1875, at Denver, Colo., and attended Jesuit College (Denver). In 1892 he started his electrical career as an apprentice with the Columbian Electric Company, but remained there for only one year before becoming associated with the West End Street Railroad Company, Denver, where he remained for 6½ years. In 1900 Mr. Connolly left the employ of the West End Street Railroad Company, and after a brief association with two mining companies in Colorado, he was employed by the Northern Coal and Coke Company and placed in charge of the electrical work for several coal mines. Two years later he became associated with the Portland Gold Mining Company, Colorado Springs, Colo., first as chief electrician and later as chief engineer of the mill department and consulting engineer of construction, remaining in the last position until 1923. Mr. Connolly left the employ of the Portland Gold Mining Company in 1923 to become affiliated with the Western Public Service Company at Scottsbluff and served that company continuously for 15 years.

PERCY ARTHUR ROBBINS (A'03) retired mining engineer, Chicago, Ill., died April 23, 1938. Mr. Robbins was born in Chicago, May 23, 1874, and was graduated from

Cornell University with the degree of mechanical engineer in 1894. For two years after his graduation he was employed by the Philadelphia (Pa.) Traction Company, and in 1896 became consulting mechanical and electrical engineer for the DeBeers Consolidated Mines, Kimberley, South Africa. Mr. Robbins became general manager of the McKinley Darragh Mines, Cobalt, Ont., Canada, in 1908, remaining there until 1911. In the latter year he became general manager of the Canadian Mining and Finance Company. Beginning in 1919 he served as managing director of the Hollinger Consolidated Gold Mines, Timmins, Ont. Mr. Robbins held several patents and introduced new methods of gold mining in South Africa and Canada. He was a member of the American Institute of Mining and Metallurgical Engineers, the Institution of Mining and Metallurgy (British), and the Canadian Institute of Mining and Metallurgy.

RICHARD GREEN (A'34) electrical superintendent of the Demerara Electric Company, Ltd., Georgetown, British Guiana, died March 29, 1938. Mr. Green was born February 14, 1885, at Georgetown, and received his technical education through the American School of Correspondence. He first became affiliated with the Demerara Electric Company in 1904 as a storekeeper; four years later he became an apprentice in the meter testing department. In 1910 Mr. Green was appointed foreman of that department, and in the following year was appointed assistant electrical engineer. From 1912 until 1923 he was foreman of the company's street railway cars and in the latter year was appointed electrical superintendent of the company. Five years later Mr. Green was placed in charge of the company's distribution system, and in the following year again became electrical superintendent, a position he held for more than nine years.

LARS RASMUS JORGENSEN (A'05, M'13) consulting hydroelectric engineer, Berkeley, Calif., died May 8, 1938. Mr. Jorgensen was born April 25, 1876 at Faaborg, Denmark, and was graduated from the University of Berlin (Germany) with the degree of electrical engineer. After serving a brief apprenticeship in Germany he came to the United States and was employed by the General Electric Company, Schenectady, N. Y., from 1901 until 1903. In the latter year he went to California, where he worked on the engineering staff of several power companies. In 1907 he became a member of the consulting engineering firm of F. G. Baum and Company, and seven years later established his own firm, the Constant Angle Arch Dam Company of San Francisco. Mr. Jorgensen became well known for his work on arch dams, and was awarded the Norman medal of the American Society of Civil Engineers in 1918.

RAY PHILIP JACKSON (A'06) engineering representative in the patent department of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., died in November 1937, according to word just received at Institute headquarters. Mr. Jackson was born at Walton, Mich., April 11, 1873, and was graduated in electrical engineering from the University of Michigan in 1902. Immediately following his graduation he became associated with the Westinghouse Company, with which he never broke his affiliation. In recent years he was manager of the materials and processes engineering department, for a time was works manager of the company's Emeryville (Calif.) plant, and for the last ten years was advisory engineer in the company's patent department.

GAILEN ELMER MEREDITH (A'19, M'26) foreman of the high-voltage laboratory, Kansas City Power and Light Company, Kansas City, Mo., died April 20, 1938. Mr. Meredith was born at Winchester, Kans., February 15, 1890, and received his formal technical education through correspondence schools and extension courses of the University of Missouri. He became affiliated with the Kansas City Power and Light Company in 1905 and was employed by that company continuously, except for two years' service in the United States Army during the World War. He became superintendent of the engineering research laboratory in 1922.

EARLE T. WALKER, JR. (A'35) inspector for the Underwriters Laboratories, Boston, Mass., died September 22, 1937, according to word just received at Institute headquarters. Mr. Walker was born December 26, 1906 at Providence, R. I., and was graduated from Wentworth Institute (Boston) in 1928. Following his graduation he was employed by D. W. Flint, Inc., where he became engaged in automotive electrical work. He had been associated with the Underwriters Laboratories since 1929.

Membership

Recommended for Transfer

The board of examiners, at its meeting on June 15, 1938, recommended the following members for transfer to the grade of membership indicated. Any objection to these transfers should be filed at once with the national secretary.

To Grade of Fellow

Cloke, Paul, dean of college of technology, University of Maine, Orono.
Douglas, J. F. H., associate professor of electrical engineering, Marquette University, Milwaukee, Wis.
Evans, H. S., dean, college of engineering, University of Colorado, Boulder.
Sayles, E. V. S., electrical engineer, The Commonwealth and Southern Corporation, Jackson, Mich.
Thompson, J. S., president, Pacific Electrical Manufacturing Corporation, San Francisco, Calif.

5 to Grade of Fellow

To Grade of Member

Diggs, V. A., engineer of plant extensions, The Ohio Bell Telephone Company, Cleveland, Ohio.
Elzi, J. A., engineer, The Commonwealth and Southern Corporation, Jackson, Mich.
Fisher, L. E., research engineer, Bull Dog Electric Products Company, Detroit, Mich.
Fleshler, A. D., assistant electrical engineer, Transit Commission, New York, N. Y.
Gilson, W. J., managing director, Eastern Power Devices, Ltd., Toronto, Ont. Canada.
Heller, J. E., system long lines supervisor, The Pacific Telephone and Telegraph Company, San Francisco, Calif.
Hovey, B. K., instructor in electrical engineering University of Alabama, University, Ala.
Kane, E. K., network transformer development engineer, General Electric Company, Pittsfield, Mass.
Leeds, W. M., electrical engineer, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
McCracken, G. W., chief engineer, Birmingham Electric Company, Birmingham, Ala.
Patterson, A., chief engineer, Southwestern Gas and Electrical Company, Texarkana, Ark.
Schott, R. C., electrical engineer, Sanderson and Porter, New York, N. Y.
Scott, H. H., engineer, General Radio Company, Cambridge, Mass.
Siegfried, V., assistant professor of electrical engineering, Worcester Polytechnic Institute, Worcester, Mass.
Smith, F. V., electrical engineer, Sargent and Lundy, Inc., Chicago, Ill.
Tate, V. R., secretary and patent attorney, Perfex Corporation, Milwaukee, Wis.
Zippler, William N., electrical engineer, Gibbs and Cox, Inc., New York, N. Y.

17 to Grade of Member

Applications for Election

Applications have been received at headquarters from the following candidates for election to membership in the Institute. If the applicant has applied for direct admission to a grade higher than Associate, the grade follows immediately after the name. Any member objecting to the election of any of these candidates should so inform the national secretary before July 31, 1938, or September 30, 1938, if the applicant resides outside of the United States or Canada.

United States and Canada

Ambos, C., John E. Fast and Company, Chicago, Ill.
Athens, E. P. (Member), Westinghouse Electric and Manufacturing Company, Miami, Fla.
Austin, W. L. (Member), Light and Power Department, Cushing, Okla.
Bishop, E. R., Canadian Westinghouse Company, Ltd., Hamilton, Ont., Canada.
Dawson, T. J., Standard X-Ray Sales Company, Dallas, Texas.
Day, J. H., I-T-E Circuit Breaker Company, Philadelphia, Pa.
Fairbanks, R. P. (Member), Twentieth Century-Fox Film Corporation, Beverly Hills, Calif.
Finnell, R. D., Kansas Gas and Electric Company, Wichita, Kans.
Fischle, C. R. (Member), New York Telephone Company, New York, N. Y.
Freedson, M., 488 Blue Hill Avenue, Roxbury, Mass.
Gillies, G. B., Gillies Brothers, Ltd., Braeside, Ont., Canada.
Gray, W. F., Texas Technological College, Lubbock.
Graybill, K. W. (Member), Automatic Electric Company and Associated Electric Laboratories, Inc., Chicago, Ill.
Harrop, J. T., M. A. Shaw, Inc., New York, N. Y.
Hill, S. C. H., Shawinigan Water and Power Company, Victoriaville, Que., Canada.
Hirsh, D. (Fellow), Hatfield Electric Company Inc., Houston, Texas.
Johnson, W. P., Toledo Edison Company, Toledo Ohio.
Jones, L. L., American Can Company, Seattle, Wash.
Kilgour, B. L. Jr. (Member), Cincinnati and Suburban Bell Telephone Company, Cincinnati, Ohio.
Krause, F., 7319 68th Road, Middle Village, N. Y.
Marshall, L. C., University of California, Berkeley, Calif.
McCurley, J. B., Western Electric Company, Baltimore, Md.
Merrill, J. R., Consolidated Edison Company of New York, Inc., Brooklyn, N. Y.
Morgan, S. C., University of British Columbia, Vancouver, B. C., Canada.
Mosele, M. P., Public Service Company of Northern Illinois, Chicago, Ill.
Neil, F. M., Sutton, Steele and Steele, Inc., Dallas, Texas.
Nichols, R. E., Connecticut Power Company, Stamford, Conn.
Onaka, T., Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.
Oppen, W. R., Ford Instrument Company, Inc., Long Island City, N. Y.
Partridge, H. R. (Member), Le Carbone Company, Inc., Boonton, N. J.
Pool, R., Southwestern Light and Power Company, Lawton, Okla.
Reed, D. G., Standard Oil of California, Richmond, Calif.
Schmitt, G. H. Jr., 4616 South Roman Street, New Orleans, La.
Smith, T. H., Cleveland Electric Illuminating Company, Cleveland, Ohio.

Smith, T. L., 79 South Main Street, South Norwalk, Conn.
Specht, W. A., South Dakota State College, Brookings.
Tanner, F. R., Cincinnati Suburban Bell Telephone Company, Cincinnati, Ohio.
Van Blarcom, P. S., Luzerne County Gas and Electric Corporation, Kingston, Pa.

Total, United States and Canada—38

Elsewhere

Anantharaman, V. M., Mettur Dam, Madras, India.
Armstrong, R. C., Melbourne Technical College, Melbourne, Victoria, Australia.
Cox, W. J. (Member), Municipality of Orange, New South Wales, Australia.
Dass, I. L., in care of Thomas Cook and Son, Ltd., London, England.
Dorra, A. Y. (Member), Ministry of Public Works, Cairo, Egypt.
Graham, R. H., Box 72, Gatun, Canal Zone.
Gupta, A. K., Perak River Hydro-Electric Power Company, Ltd., Perak, Federated Malay States.
Ramaswamy, S., Malabar Spinning and Weaving Mills, Ltd., South Malabar, India.
Seshachar, K. V., Tata Iron and Steel Company, Ltd., Jamshedpur, India.
Yamaki, N., Kobe Works, Mitsubishi Denki K. K., Wadamisaki, Kobe, Japan.

Total, elsewhere—10

Addresses Wanted

A list of members whose mail has been returned by the postal authorities is given below, with the addresses as they now appear on the Institute record. Any member knowing of corrections to these addresses will kindly communicate them at once to the office of the secretary at 33 West 39th St., New York, N. Y.

Ackerson, Cornelius, 2600 West Grand Boulevard, Detroit, Mich.
Alden, Verne E., 1440 Tower Road, Winnetka, Ill.
Elliott, Chester, Box 201, Hobart Mills, Calif.
Finsterwalder, Carl J., 4 Kanes Park, New York N. Y.
Lynch, Earl M., 34–40 West Beaver Street, Jacksonville, Fla.
Markham, Thomas C., Jr., 55 Hanson Place Brooklyn, N.Y.
Neiman, William E., 4060 Elbertson Street, Elmhurst, N. Y.
Nissar, A. R., in care of Thomas Cook and Son, 2 Place de la Madeleine, Paris, France.
Piltch, Abraham, 2224 Eutaw Place, Baltimore, Md.
Powers, Walter H., 603 West Washington, Jackson, Mich.
Willick, Francis L., 2397 East Grand Boulevard, Detroit, Mich.

11 Addresses Wanted

Engineering Literature

New Books in the Societies Library

Among the new books received at the Engineering Society Library, New York recently are the following which have been selected because of their possible interest to the electrical engineer. Unless otherwise specified, books listed have been presented gratis by the publishers. The Institute assumes no responsibility for statements made in the following outlines, information for which is taken from the preface of the book in question.

PRINCIPLES of ELECTRIC POWER TRANSMISSION. By L. F. Woodruff. Second edition. New York, John Wiley and Sons, 1938. 257 pages, illustrated, 9 by 6 inches, cloth, $3.50. Presents the fundamental scientific principles involved in power transmission and the methods whereby they may be applied to practical engineering problems. Intended for students already familiar with fundamental circuit theory and the operating characteristics of the more important types of a-c machinery, and with the use of complex quantities in calculations. The new edition has been largely rewritten. Improved methods of calculation have been incorporated, mechanical principles treated more fully, and chapters added upon power limits and stability and upon the calculation of fault currents.

THOMAS' REGISTER of AMERICAN MANUFACTURERS, 28th edition, 1938. New York, Thomas Publishing Company, illustrated, 14 by 9 inches, cloth, $10.00 to old subscribers, $15.00 to new subscribers. An annual compilation of American manufacturers. Contains three main sections: A classified directory of products (with index) in which the firms are listed with a capital rating, geographically under each product; an alphabetical list of manufacturers, giving addresses, subsidiaries, branches, etc.; and a trade name index.

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA. New York, D. Van Nostrand Company, 1938. 1233 pages, illustrated, 11 by 8 inches, leather, $10.00. Aims to provide a reference book covering the basic sciences of physics, chemistry, mineralogy, geology, botany, astronomy, and mathematics; and the applied sciences of engineering, medicine, navigation, and aeronautics. Over ten thousand terms of interest are included, with definitions and fundamental information.

PHOTOELEMENTS and THEIR APPLICATION. By B. Lange, translated by A. St. John. New York, Reinhold Publishing Corporation, 1938. 297 pages, illustrated, 9 by 6 inches, cloth, $5.50. Presents a historical review of the development of photoelements and deals with the theories of semiconductor photoeffects and the properties of photocells. A second section is devoted to the construction and properties of photocells and to their various applications.

ELECTRON and NUCLEAR PHYSICS. By J. B. Hoag. Second edition. New York, D. Van Nostrand Company, 1938, 502 pages, diagrams, charts, tables, 9 by 6 inches, cloth, $4.00. A presentation of the experimental evidence for those concepts which lie in the domain of electron and nuclear physics. The first section concerns the characteristics and emission of electrons; the second, nuclear phenomena including transmutations; and the third, laboratory technique.

Celebration a Lyon du Centenaire de la Mort d' ANDRÉ-MARIE AMPÈRE, 1836–1936. Two volumes, Société des Amis d'André-Marie Ampère, 170 Ave. Jean-Jaurès, Lyon, France, 1936. 523 pages, illustrated, 11 by 9 inches, paper, 100 frs. Contains the proceedings at a commemoration of the centenary of Ampère's death, held at Lyons on March 5 to 8, 1936. The lectures discuss the work of Ampère and also modern developments in electrical engineering.

KINETIC THEORY of GASES. By E. H. Kennard. New York and London, McGraw-Hill Book Company, 1938. 483 pages, diagrams, charts, tables, 9 by 6 inches, cloth, $5.00. Treats the traditional kinetic theory of gases from a modern viewpoint. Suitable for use as a textbook for upper-class students. Contains two chapters of graduate grade on wave mechanics and general statistical mechanics. The electrical and magnetic properties of gases are treated only briefly.

SCIENCE and MUSIC. By Sir J. Jeans. New York, The Macmillan Company, 1937. 258 pages, illustrated, 9 by 6 inches, cloth, $2.75. Considers music from the viewpoint of physics. Gives the physical explanation for various phases of the art, such as sound representation by curves, sounds produced by stretched strings and by air columns, harmony, scales, acoustics, and the physiological interpretation of sound.

HOCHFREQUENZ MESSTECHNIK. (Physik und Technik der Gegenwart, Bd. 3.) By O. Zinke. Leipzig, S. Hirzel, 1938. 223 pages illustrated diagrams, charts, tables, 9 by 6 inches, paper, 15.50 rm. Describes fundamental high-frequency measurements and equipment. Chapters cover the measurement of current, voltage, power, frequency; harmonic vibration; modulation; resistance, capacitance, inductance; conductors and cables.

EINFÜHRUNG in die VIERPOLTHEORIE der ELEKTRISCHEN NACHRICHTENTECHNIK. (Physik und Technik der Gegenwart, volume 2). By R. Feldtkeller. Leipzig, S. Hirzel, 1937. 142 pages, charts, diagrams, tables, 9 by 6 inches, paper, 8.80 rm.; bound, 10 rm. A mathematical treatment of those phases of the quadripole theory which have practical applications in electrical communications.

MAGNETISM. (Physics in Industry). London, Institute of Physics, 1938. 102 pages, illustrated, 10 by 6 inches cloth, 4s. 6d. plus 4d. postage. Contains six lectures by physicists and engineers, delivered in 1937 before the Manchester and district branch of the Institute of Physics, designed to survey present knowledge of the magnetic properties of materials.

VDEF-achberichte, Bd. 9, 1937. Berlin-Charlottenburg, ETZ-Verlag. 242 pages, illustrated, 12 by 8 inches, paper, 12 rm. Contains 59 papers presented at the 39th (1937) meeting of the Verband Deutscher Elektrotechniker. These papers discuss all branches of electrical engineering and give a good review of the present state of the art in Europe.

WAGE INCENTIVE METHODS. By C. W. Lytle. New York, Ronald Press Company, 1938. 468 pages, diagrams, charts, tables, 9 by 6 inches, cloth, $6.00. Aims to assist the selection of the best wage plan for any business, by providing means for comparison of possible methods. Presents all the basic incentive plans in use, with their variations and modifications.

WOOD PRESERVATION. By G. M. Hunt and G. A. Garratt. New York and London, McGraw-Hill Book Company, 1938. 457 pages, illustrated, 9 by 6 inches, cloth, $5.00. Summarizes the essential facts on wood preservation and discusses the agencies of wood deterioration, wood preservatives, preserving processes and equipment, and the properties of treated wood.

TROCKENGLEICHRICHTER. By K. Maier. Munich and Berlin, R. Oldenbourg, 1938. 313 pages, illustrated, 10 by 7 inches, cloth, 18 rm. Describes the general construction and method of operation, the three customary types of dry rectifiers, and the electrical properties of the barrier layer. Devotes some space to the calculations of rectifier operation under different kinds of loads.

GROSSE INGENIEURE, Lebensbeschreibungen aus der Geschichte der Technik. By C. Matschoss. Munich and Berlin, J. F. Lehmanns Verlag, 1937. 334 pages, illustrated, 9 by 6 inches, cloth, 8.40 rm. (6.30 rm. in U.S.). Short biographies of a number of great engineers from all periods of historical time, the information concerning mainly their lives rather than their technical work.

ESSENTIALS of ENGINEERING MATHEMATICS. By J. P. Ballantine. New York, Prentice-Hall, 1938. 502 pages, diagrams, charts, tables, 9 by 6 inches, cloth, $3.75. Considers differential and integral calculus side by side with those parts of analytic geometry, trigonometry, and college algebra that seem logically connected with or dependent on the calculus.

ELECTRICAL MACHINERY. By T. Croft, revised by G. H. Hall. Fourth edition. New York and London, McGraw-Hill Book Company, 1938. 394 pages, illustrated, 8 by 5 inches, cloth, $3.00. The object of this book is to answer the questions of the practical electrical worker and to prepare the beginner to undertake jobs in electrical machinery installation, operation, and maintenance.

KURZSCHLUSSSTRÖME in DREHSTROMNETZEN. By M. Walter. Second edition. Munich and Berlin, R. Oldenbourg, 1938. 167 pages, illustrated, 10 by 6 inches, cloth, 8.80 rm. A treatise on short-circuit currents in three-phase lines. Considers methods of suppression and the protective capacity of switches and fuses.

THE ELECTRICAL ELEMENTS and NEUTRONS AS CLOSED SYSTEMS OF MOVING MATTER, describing a method of their development; nonmathematical. By J. B. Marquis. 8 pages, 8½ by 8¾ inches, 7 illustrations, paper, 30¢. Published by the author (Boonton, N. J.)

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Papers Presented at Winter Convention, New York, N. Y., January 24–28, 1938

No.	Authors	Titles of Papers (Some Shortened)
☐ 37-91	Aiken & Birdsall	*Sharp Cut-Off in Vacuum Tubes, Slide-Back Voltmeter
☐ 37-100	Hardaway & Lewis	*Test and Operation of Petersen Coil on 100-Kv System
☐ 37-101	Woodruff	*Transmission-Line Transients in Motion Pictures
☐ 37-112	Sporn and Muller	*The Application and Performance of Carrier-Current Relaying
☐ 37-114	Kierstead	*Some Schemes of Current-Limiting Reactor Applications
☐ 37-115	McEachron & McMorris	*Discharge Currents in Distribution Arresters—Part II
☐ 37-121	Hirshfeld	*The PCC Street Car
☐ 37-122	Fitzgerald	*Results of Operation of PCC Cars in Pittsburgh
☐ 37-132	Evans & Monteith	Recovery Voltage Characteristics of Transmission Systems
☐ 37-134	Odessey & Weber	Critical Conditions in Ferroresonance
☐ 37-135	Coleman & Schirmer	*Protection Features for the Joint Use of Wood Poles
☐ 37-136	Montsinger	*Co-ordination of Power Transformers for Steep-Front Waves
☐ 37-137	Sporn & Lusignan	*Lightning Strength of Wood in Power-Transmission Structures
☐ 37-139	Wyatt, Smart & Reynar	*Mechanical Uniformity of Paper-Insulated Cables
☐ 37-140	Richter	*An Electronic Arc-Length Monitor
☐ 37-141	Heitman	*The Rating of Resistance-Welding Transformers
☐ 37-142	Hansen	*Interpretation of Oscillograms of Arc-Welding Generators
☐ 37-154	Reed	*The Properties of Three-Phase Systems Deduced With Matrices
☐ 37-169	Vernam	*Printing Telegraph Operation of Way Wires
☐ 37-171	Kennedy & Hayward	*Harmonic-Current-Restrained Relays for Differential Protection
☐ 37-174	Schneider	*Thyratron Reactor Lighting Control
☐ 37-179	Chesnut, Ilgenfritz & Kenner	*Cable Carrier-Telephone Terminals

Papers Presented at North Eastern District Meeting, Lenox, Mass., May 18–20, 1938

☐ 38-40	McEachron	Multiple Lightning Strokes—II
☐ 38-41	Lennox & DeBlieux	A Direct-Current Transformer
☐ 38-42	LaPierre & Mansfield	Photoelectric Weft-Straightener Control
☐ 38-44	Sporn & Gross	Protector-Tube Application and Performance on 132-Kv Lines—II
☐ 38-45	Brosnan	System Planning and Operation for Voltage Control
☐ 38-46	Benner & Lunge	Voltage-Regulating-Equipment Characteristics
☐ 38-47	Landis	Voltage Regulation and Control of Rural Lines
☐ 38-48	Burrell & Appleton	The Periodic Voltage Survey as a Basis for Distribution Design
☐ 38-49	Rogers	Regenerative Tension Control for Paper Winders
☐ 38-50	Bendz	Comparison of Methods of Stopping Squirrel-Cage Induction Motors
☐ 38-51	Von Sothen	The Application of Capacitors in Industrial Plants
☐ 38-52	Vogel	Corona Voltages of Typical Transformer Insulation

Papers Presented at Summer Convention, Washington, D. C., June 20–24, 1938

☐ 37-58	Smith & Weygandt	Double Line-to-Neutral Short Circuit of an Alternator
☐ 37-866	Appleman	The Cause and Elimination of Noise in Small Motors
☐ 38-53	Calvert	Amplitudes of the MMF Harmonics for Fractional Slot Windings
☐ 38-54	Porter	Positive-Grid Characteristics of Triodes
☐ 38-55	Bewley	Traveling Waves Initiated by Switching
☐ 38-56	Subcommittee Report	Line-Type Lightning-Arrester Performance Data
☐ 38-57	Fonda	The Fundamental Principles of Fluorescence
☐ 38-58	Whitehead	Lightning Protection of 22-Kv Substations
☐ 38-59	Poritsky	Graphical Field-Plotting Methods in Engineering
☐ 38-60	Reagan	A Self-Checking System of Supervisory Control
☐ 38-61	Race	Tests on Oil-Impregnated Paper—III—Fluid Flow
☐ 38-62	Spurck & Strang	A New Multibreak Interrupter for Fast-Clearing Breakers
☐ 38-63	Champe & Von Voigtlander	System Analysis for Petersen Coil Application
☐ 38-64	Gulliksen	A Position Regulator for Paper Slitters
☐ 38-65	Prince & Williams	The Current-Limiting Power Fuse
☐ 38-66	Clem	Application of Capacitance Potential Devices
☐ 38-67	Curry	The Co-ordination of Mathematics and Physics
☐ 38-68	Malti	Mathematics and Physics in Engineering
☐ 38-69	Stanley	An Analysis of the Induction Machine
☐ 38-70	Brownlee & Dent	Remote Control of Network Protectors
☐ 38-71	Bellaschi & Aggers	Radio-Influence Characteristics of Electrical Apparatus
☐ 38-72	Cole	Flashover Characteristics of Transformer Condenser Bushings
☐ 38-73	Terman	Analysis and Design of Harmonic Generators
☐ 38-74	Schelkunoff	Transmission Theory of Spherical Waves
☐ 38-75	Lyman & North	Application of Large Phase-Shifting Transformer
☐ 38-76	Morgan	Co-ordination of Mathematics and Physics With EE Subjects
☐ 38-77	Inglis	Transmission Features of the New Telephone Sets
☐ 38-78	Wahlquist & Taylor	Noise Co-ordination of Rural Power and Telephone Systems
☐ 38-79	Dwight & Wang	Reactance of Square Tubular Bus Bars
☐ 38-80	Shannon	A Symbolic Analysis of Relay and Switching Circuits
☐ 38-81	Jones	Instruments for the New Telephone Sets
☐ 38-82	Teare	A Course to Develop Facility in Mathematics and Physics
☐ 38-83	Bryant	Co-ordination of Physics With Electrical Engineering
☐ 38-84	Sporn & St. Clair	Tests and Performance of a High-Speed Multibreak Breaker
☐ 38-85	Dickinson	"De-ion" Air Circuit Breakers
☐ 38-86	Sandin	Enclosed Low-Voltage "De-ion" Breaker of High Capacity
☐ 38-87	Treanor	The Wound-Core Distribution Transformer
☐ 38-88	Sorensen	The Economic Status of the Engineer
☐ 38-90	Williams	Combined Thyratron and Tachometer Control of Small Motors
☐ 38-91	Summers	A Static Constant-Current Circuit
☐ 38-92	Hazeltine	Basic Equations for Electric and Sound Radiation
☐ 38-93	Inman & Thayer	Low-Voltage Fluorescent Lamps
☐ 38-94	McDermott	High-Voltage Gaseous and Fluorescent Tubes
☐ 38-95	Pakala	A Memory Attachment for Oscilloscopes
☐ 38-96	Kouwenhoven & Lotz	Absolute Power Factor of Air Capacitors
☐ 38-97	Rusher & Mershon	The Electric Strain Gauge
☐ 38-98	Concordia, Crary & Lyons	Stability Characteristics of Turbine Generators

* These papers have been published in the TRANSACTIONS section of ELECTRICAL ENGINEERING.